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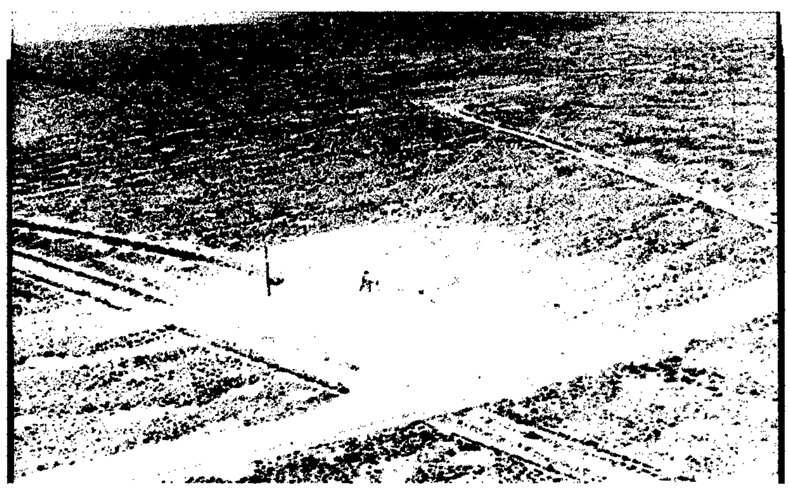
Sampling Results for AEC Phase I Training Ordnance Emission Characterization

Volume I—Summary Report,
Appendix I-A—Analyte Lists,
Appendix I-B—Emission Factor Summary Data,
Appendix I-C—Sample Calculations, and
Appendix I-D—MIDAS Data

March 1999



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13. ABSTRACT *(Maximum 200 words)* Under the direction of the U.S. Army Environmental Center (USAEC), Dugway Proving Ground's, West Desert Test Center was tasked to conduct a series of tests to quantify the emission products produced when training ordinance are used in their tactical configurations. This Summary report, as part of a larger effort, evaluates eight training ordnance commonly in use. The L594 Simulator Ground Burst, the L601 Simulator Hand Grenade, the L596 M110 Simulator Flash Artillery, The D505 155MM Illumination Round, the L305 Green Parachute Signal Flare, the L312 White Parachute Signal Flare and the L314 Green Star Cluster Signal Flare. These items were detonated in DPG's Thermal treatment characterization facility known as the BangBox™.

The BangBox™ is a 50-foot diameter hemisphere made from plasticized fabric, which is kept rigid by a constant injection of fresh air and a semi-rigid airlock. Within the test chamber are samplers, a steel-lined detonation pit, an automatically regulated inflation blower, environment control equipment, and a sampling tube, which extends into the airlock. This attached airlock admits personnel and allows for the movement of large equipment into the chamber. Real-time analyzers were electronically connected to a data recorder. EPA approved laboratories provided sampling and analysis data regarding total suspended particulates (TSP), particulate matter less than 10 microns in diameter (PM_{10}), toxic metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), hydrogen chloride (HCl), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and dioxins/furans.

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SAMPLING RESULTS FOR ARMY ENVIRONMENTAL CENTER (AEC) TRAINING ORDNANCE EMISSION CHARACTERIZATION

VOLUME I, PHASE I—SUMMARY REPORT
APPENDIX I-A—ANALYTE LISTS,
APPENDIX I-B—EMISSION FACTOR SUMMARY DATA,
APPENDIX I-C—SAMPLING CALCULATIONS, AND
APPENDIX I-D—MIDAS DATA

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FOREWARD

The work reported in this document is authorized under TECOM Test Directive No. 8-CO-160-000-030. It is sponsored by the Army Environmental Center in support of a Massachusetts Military Reservation Munitions Emission Products Characterization Study.

This summary report is the first part of a three-phase study. Phase I, as reported here, contains the characterization data of eight simulator and pyrotechnic munitions. Phase II will study five additional ordnance items, while Phase III is devoted exclusively to smoke.

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ACRONYMS

AEC	U.S. Army Environmental Center
CEM	Continuous Emissions Monitoring
CFR	Code of Federal Regulations
Cl_2	Chlorine
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CP	Command Post
CVAA	Cold Vapor Atomic Absorption
DAS	Data Acquisition System
DPG	Dugway Proving Ground
EPA	U.S. Environmental Protection Agency
GC	Gas Chromatography
HCl	Hydrogen Chloride
HF	Hydrogen Fluoride
ICP	Inductively Coupled Plasma
LCSD	Laboratory Control Sample Duplicates
LCS	Laboratory Control Sample
MIDAS	Munitions Items Disposition Action System
MSD	Matrix Spike Duplicate
MS	Matrix Spike
NEW	Net Explosive Weight
NO_x	Nitrogen Oxides
PM_{10}	Particulates less than 10 microns
PUF	Polyurethane Foam
QC	Quality Control
Radian	Radian International LLC
RPD	Relative Percent Difference
SF_6	Sulfur Hexafluoride
SO_2	Sulfur Dioxide
SVOC	Semivolatile Organic Compound
TEQ	Toxic Equivalent
TSP	Total Suspended Particulates
VOC	Volatile Organic Compound

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EXECUTIVE SUMMARY

Dugway Proving Ground (DPG,) under the direction of the U.S. Army Environmental Center, has been tasked to conduct a series of tests to quantify the emission products produced when training ordnance are used in their tactical configurations. This information is required to support Army responses to regulatory questions directed at training and testing as well as to support, define, and/or possibly modify future Army training/testing practices. As an example, Administrative Orders issued by the U.S. Environmental Protection Agency (EPA) Region I severely restricted training operations at the Massachusetts Military Reservation. The Administrative Orders asserted that training operations were degrading the environment and endangering the sole source drinking water aquifer, thus putting the residents of Cape Cod at risk. The Army questioned the validity of the claims made by EPA but was unable to provide sufficient data regarding training range emissions and the fate and transport of those emissions in the environment.

This summary report, as part of a larger effort, evaluates the following eight training ordnances commonly in use: M117 Simulator Booby Trap Flash, L594 Simulator Ground Burst, the L601 Simulator Hand Grenade, the L596 M110 Simulator Flash Artillery, the D505 155mm Illumination Round, the L305 Green Parachute Signal Flare, the L312 White Parachute Signal Flare, and the L314 Green Star Cluster Signal Flare.

These items were detonated in DPG's thermal treatment characterization facility known as the BangBox™. The BangBox™ is a 50-ft diameter hemisphere made from plasticized fabric, which is kept rigid by a constant injection of fresh air and a semirigid airlock. Within the test chamber are samplers, a steel-lined detonation pit, an automatically regulated inflation blower, environment control equipment, and a sampling tube, which extends into the airlock. This attached airlock admits personnel and allows for the movement of large equipment into the chamber. Real-time analyzers are electronically connected to a data recorder.

Under DPG's guidance, EPA-approved laboratories have provided sampling and analysis support for this characterization effort. Contained in this report are their analysis data regarding total suspended particulates, particulate matter less than 10 microns in diameter, toxic metals, volatile organic compounds, semivolatile organic compounds, hydrogen chloride, carbon monoxide, nitrogen oxides, sulfur dioxide, and dioxins/furans.

Based on the measured concentrations generated from deployment of each of the eight training ordnance items, average emission factors (in pounds pollutant per item) were developed for each detected compound. Average emission factors were also expressed as pounds pollutant per pound of energetic material. The results showed that similar types of compounds were produced by all the items tested. However, the compound-by-compound emissions varied between items, even for similar training ordnance. Overall assessment of these tests is that the results are reasonable and accurate based on general observations, instrument calibrations, and analysis of field and laboratory quality control samples.

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1. INTRODUCTION

Radian International LLC (Radian), under contract with the U.S. Army Dugway Proving Ground (DPG), provided air sampling and analytical support on behalf of the U.S. Army Environmental Center (AEC) at the BangBox test facility. The AEC has developed a program to identify and quantify the emissions resulting from range operations that involve weapons firing and the use of pyrotechnic devices. The objective of the testing was to generate emission factors for airborne compounds associated with AEC training ordnance. This report only delineates information related to air emissions. There has been no assessment or determination of hazard levels. However, the data may be used for air dispersion modeling and as inputs for environmental fate and transport modeling to evaluate health hazards and risks. The Phase I testing was performed in the BangBox on 28 March to 1 April 1998. The airborne compounds measured included:

- Total suspended particulates (TSP),
- Particulate matter less than 10 microns (PM_{10}),
- Metals,
- Volatile organic compounds (VOCs),
- Tracer compound sulfur hexafluoride (SF_6),
- Semivolatile organic compounds (SVOCs),
- Hydrogen chloride (HCl) and chlorine (Cl_2),
- Dioxins/Furans,
- Carbon monoxide (CO),
- Carbon dioxide (CO_2),
- Nitrogen oxides (NO_x), and
- Sulfur dioxide (SO_2).

This report consists of five volumes. In Volume I, Section 1.0 describes the BangBox test facility and the testing. Section 2.0 describes the sampling and analytical procedures used. Section 3.0 presents and discusses the sampling results from the tests and discusses the data quality based on the analytical results. Section 4.0 presents conclusions based on the analytical results. Appendix I-A provides the analyte lists for this test program, which includes all compounds sought. Appendix I-B provides average emission factor summary data developed for each training item. The sample calculations in Appendix I-C show how analytical data and field data were used to determine emission factors. Appendix I-D contains the components of each item as listed in the Munitions Items Disposition Action System (MIDAS). Volume II provides the summary data for all compounds. Appendix II-A provides detailed emission factor results. Appendix II-B provides dilution correction factor data and calculations. Appendices II-C through II-I provide summary data results for TSP, PM_{10}, metals, VOCs and tracers, SVOCs, HCl/Cl_2, dioxins/furans, and continuous emissions monitoring (CEM), respectively. Appendix II-J contains the field data sheets and calibration data for the sampling equipment. Appendix II-K contains the sampling plan letters of instruction used for these tests. Volumes III, IV, and V contain the analytical data reports.

1.1 Test Facility Description

The BangBox test facility includes a test chamber, a data acquisition system (DAS), a command post (CP), and an instrument building. The BangBox facility is a 15.2-m (50 ft) diameter (1,000 m^3) hemisphere constructed of coated fabric anchored onto a concrete pad.

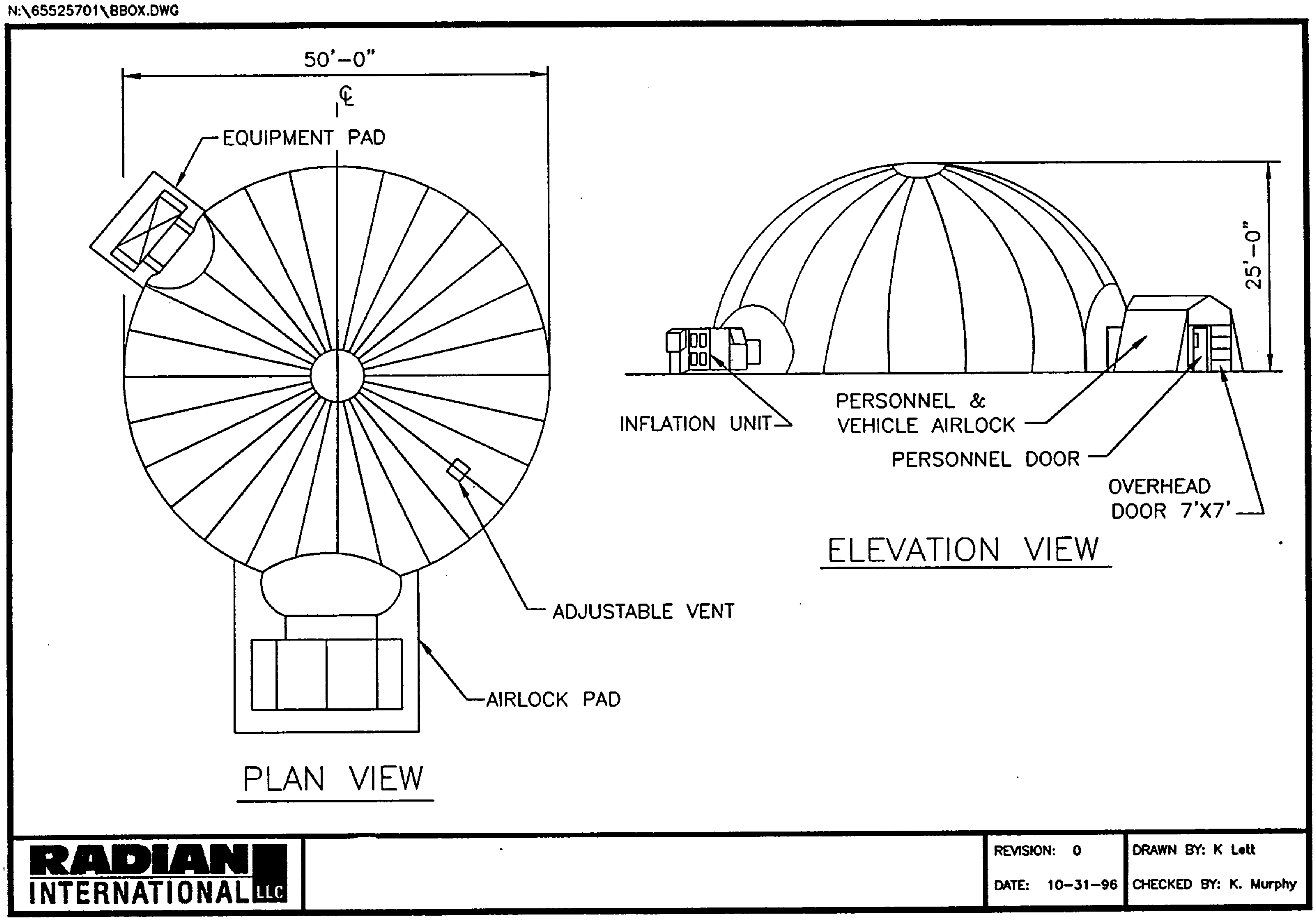

Figure 1. Schematic Drawing of BangBox at DPG

A small blower provides filtered air to keep the chamber inflated at a constant positive pressure. Figure 1 is a schematic of this facility.

The resiliency of the inflatable structure permits the detonation of up to 0.5 lb TNT equivalent or burning of up to approximately 5 lb of energetic material without damage to the structure. The chamber's nominal volume holds substantially more than sufficient air for complete combustion, thus emulating actual open air conditions.

The BangBox is also equipped with an overpressure hatch, which is a weighted trap door located in the roof of the test chamber entryway. The hatch opens whenever there is an overpressure in the BangBox to protect the structure from stress rupture. This hatch may also be used to purge the test chamber after a test has been completed or to rapidly purge the chamber before testing begins.

A CP is maintained about 550 m from the BangBox facility and contains the DAS file server, remote DAS monitors, the detonation/ignition firing system firing station, and work stations for test support. The test items are deployed remotely; the firing circuit terminates in a locked box in the CP accessible only to authorized personnel.

1.2 Test Summary

The BangBox tests included deploying the ordnance and monitoring the content of the resultant plume. Hand-held or mounted items that were detonated (e.g., simulator hand grenades, simulator booby traps) were installed in a frame and deployed remotely (e.g., by pulling strings). Flares were deployed by launching into a sand-filled pit. No burn pans were used, and the BangBox was cleaned between items to remove any remaining residue.

Table 1 summarizes the air sampling matrix for each munition item tested as part of Phase I. Two test runs were void during testing, and data results are not included in this report. These test runs were repeated. Simulator Booby Trap Flash M117 Run No. 1 was void because only 1 of 65 munition items fired. White Parachute Signal Flare Run No. 1 was void because one of the items did not fully deploy. Table 2 summarizes the munition item constituents based on data for each training item. The data were obtained from MIDAS.

Table 1. Sampling Matrix for Phase I BangBox Testing and Evaluation

Item	DODIC	Number of Trials	NEW per Item (lb)	Number of Items	TSP (Hi-Vol.)	PM_{10}	Metals	VOC (TO-14, TO-12)	SVOC (8270)	HCl/Cl_2 (M-26)	Dioxin/Furan (8290)	CEM
Simulator Booby Trap Flash M117	L598	1	0.0077	29	2/trial	2/trial	2/trial	3/trial	2/trial	2/trial	2/trial	a
Simulator Flash Artillery M110	L596	2	0.1875	1/1	2/trial	2/trial	2/trial	2/trial	1+Comp/trial[b]	2/trial	1+Comp/trial[b]	a
Simulator Hand Grenade	L601	2	0.081	4/4	2/trial	2/trial	2/trial	2/trial	1+Comp/trial[b]	2/trial	1+Comp/trial[b]	a
Simulator Ground Burst	L594	2	0.14	2/3	2/trial	2/trial	2/trial	2/trial	1+Comp/trial[b]	2/trial	1+Comp/trial[b]	a
Green Star Cluster Signal Flare	L314	1	1.669	1	2/trial	2/trial	2/trial	3/trial	2/trial	2/trial	2/trial	a
Green Parachute Signal Flare	L310	1	0.316	1	2/trial	2/trial	2/trial	3/trial	2/trial	2/trial	2/trial	a
White Parachute Signal Flare	L312	1	0.2827	1	2/trail	2/trial	2/trial	3/trial	2/trial	2/trial	2/trial	a
155mm Illumination Round	D505	1	6.123	1	2/trial	2/trial	2/trial	3/trial	2/trial	2/trial	2/trial	a
Total number of plume samples					22	22	22	27	19	22	19	
Background/ ambient samples					6	6	2	6	6	6	6	
Blanks					2	2	2		2	2	2	
Total number of samples					30	30	26	33	27	30	27	

CEM = Continuous Emission Monitor
Cl_2 = Chlorine
DODIC = Department of Defense Identification Code
HCl = Hydrogen Chloride
NEW = Net Explosive Weight
PM_{10} = Particulate Matter less than 10 microns
SVOC = Semivolatile Organic Compound
TSP = Total Suspended Particulates
VOC = Volatile Organic Compound

[a]Continuous monitors for CO, CO_2, NO_x, SO_2, and HCl.
[b]For each trial there were four PS-1 samplers dedicated to sampling. Two PS-1 samplers (A and B) were used for SVOCs (GC/MS) and the other two (C and D) for dioxins/furans. The XAD-2 resin was changed after each trial on samplers A and C, but not on samplers B and D, which are composite samplers.

Table 2. Phase I Munition Item Constituents

Item	Magnesium Powder	Manganese Powder	Potassium Perchlorate	Lead Styphnate	Barium Nitrate	Gasoline	Barium Chromate	Smokeless Powder	Antimony Sulfide	Barium Oxalate	Cobalt Naphthenate	Sulfur	Charcoal	Lead Chromate	Aluminum Powder	Potassium Chlorate	Red Phosphorus	Cadmium Chromate	Black Powder[a]	Chromium Oxide
Simulator Booby Trap Flash M117	X		X						X			X	X			X	X			
Simulator Flash Artillery M110	X		X		X	X		X		X										
Simulator Hand Grenade	X		X									X	X		X		X		X	
Simulator Ground Burst			X									X	X		X		X		X	
Green Star Cluster Signal Flare	X		X	X	X		X		X		X				X				X	X
Green Parachute Signal Flare	X		X	X	X		X		X			X	X		X			X	X	X
White Parachute Signal Flare	X		X	X	X		X		X		X	X	X		X				X	X
155mm Illumination Round	X	X			X		X					X	X	X					X	

[a]Black Powder constituents include charcoal, potassium nitrate, and sulfur.

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2. SAMPLING AND ANALYTICAL PROCEDURES

This section discusses the equipment setup and the sampling and analytical procedures used during this test program.

2.1 Equipment Setup

Samples of the gas inside the test chamber were collected following each test. The items to be deployed were placed in the center of the chamber. The tracer gas was released into the chamber at the same time as the deployment of the munition items. Ambient analyzers to measure TSP/metals, SVOCs, PM_{10}, and dioxins/furans are located inside the chamber. These analyzers are configured so that they can be started remotely. The sampling rate was monitored remotely and recorded by DAS. A heated probe conveys gases from the chamber into a manifold in the adjacent instrumentation building. This manifold distributes the gases to the continuous analyzers (CO, CO_2, HCl, NO_x, and SO_2) and manual samplers (VOC and SF_6 canisters) in the instrumentation building. Figure 2 is a schematic of the sampling equipment as it was configured for the BangBox testing.

2.2 Sampling and Analytical Methods

The sampling and analytical methods for the testing are described below. The sampling and analysis methodology for each sample type is summarized in Table 3.

TSP. The concentration of TSP was collected and determined gravimetrically in accordance with 40 Code of Federal Regulations (CFR) 50, Appendix B. The filters were weighed before and after testing to determine the net weight gain of particles on each filter. The concentration of the TSP was computed as the mass of collected particles divided by the volume of air sampled, corrected to standard conditions.

PM_{10}. The concentration of PM_{10} was determined gravimetrically in accordance with 40 CFR 50, Appendix J. The filters were weighed before and after testing to determine the net weight gain of particles on each filter. The concentration of PM_{10} was computed as the mass of collected particles divided by the volume of air sampled, corrected to standard conditions.

Metals. The material collected on the quartz fiber filter used for the determination of TSP, as discussed above, was used for the determination of particulate metals. After the filter was weighed to determine the TSP concentration, an aliquot of the TSP was digested with concentrated hydrogen fluoride and nitric acid per U.S. Environmental Protection Agency (EPA) Method 29. The digestate was then analyzed for mercury using cold vapor atomic absorption (CVAA) spectrometry in accordance with Method 7470 and all other metals by inductively coupled argon plasma emission spectrometry in accordance with Method 6010A. Appendix I-A presents the list of target metals for this test program.

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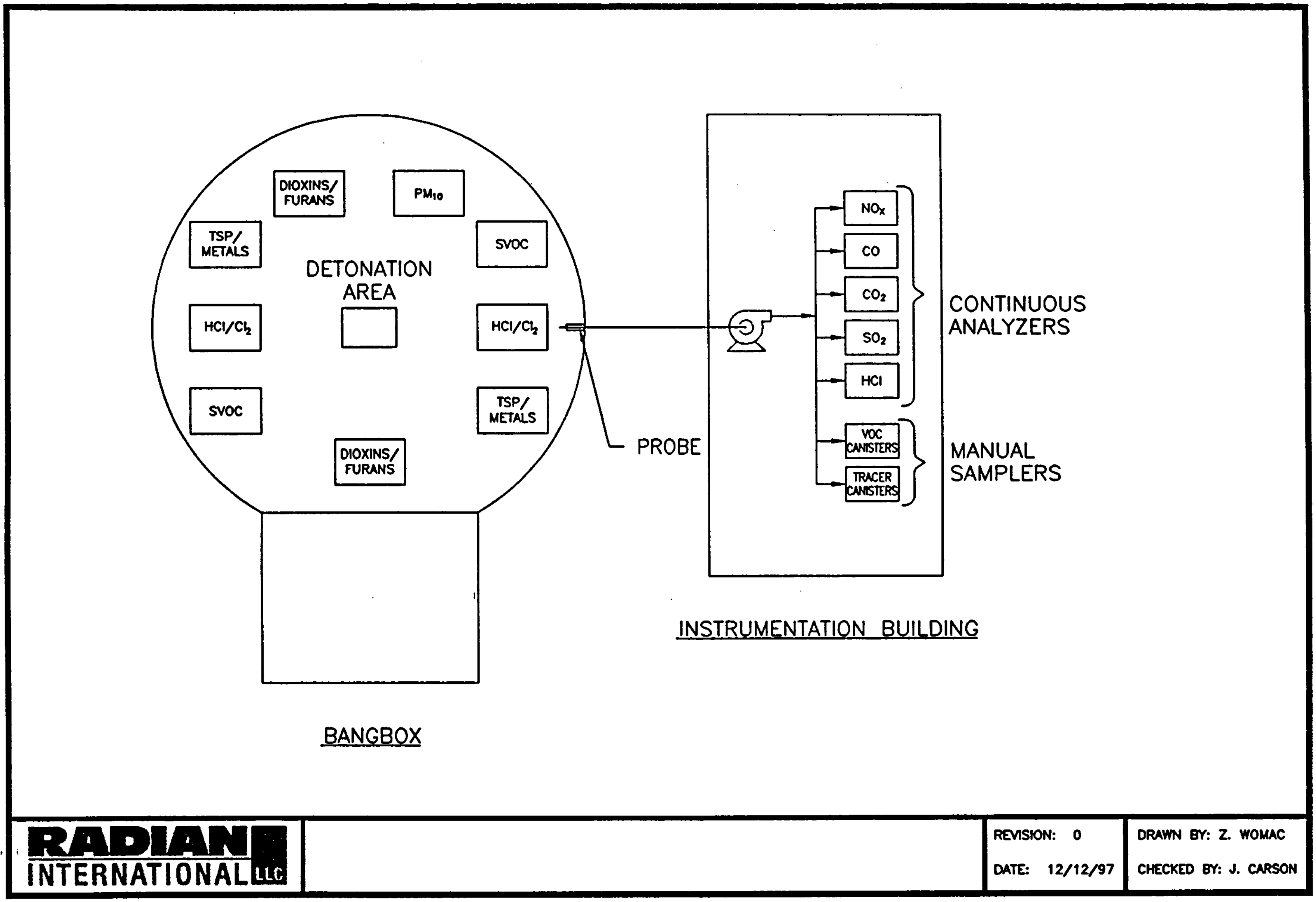

Figure 2. Sampling System Layout

Table 3. Sampling and Analysis Methods

Analytical Target	Sampling Equipment	Sampling Method[a]	Analytical Method	Laboratory
TSP	Particulate filter	40 CFR 50 Appendix B	40 CFR 50 Appendix B	Radian
PM_{10}	PM_{10} filter	40 CFR 50 Appendix J	40 CFR 50 Appendix J	Radian
Metals	Particulate filter	40 CFR 50 Appendix B	40 CFR 60 Appendix A EPA Method 29[b]	Radian
VOC	SUMMA® canisters	EPA Compendium Methods TO-12 and TO-14	EPA Compendium Methods TO-12 and TO-14	OGI
Tracer compound (SF_6)	Canisters	Grab	GC/Electron Capture Detector	OGI
SVOC	Modified PS-1 samplers	Modified EPA Compendium Method TO-13	SW-846 Method 8270	Radian
HCl/Cl_2	Mini-impinger train	40 CFR 60 Appendix A EPA Method 26	EPA Method 9057	Radian
Dioxins/furans	Modified PS-1 sampler	EPA Compendium Method TO-9	SW-846 Method 8290	Radian/Triangle
CO, CO_2, NO_X, SO_2, HCl	CEM	40 CFR 60 Appendix A EPA Methods 3A, 6C, 7E, and 10	40 CFR 50 Appendices A, C, and F	None

[a]The sampling equipment and methods used during the tests were based on standard methods, as indicated. Method modifications were made if necessary to accommodate the testing characteristics of the BangBox.
[b]Analyses of TSP.

CEM = Continuous Emissions Monitor
CFR = Code of Federal Regulations
Cl_2 = Chlorine
CO = Carbon Monoxide
CO_2 = Carbon Dioxide
EPA = U.S. Environmental Protection Agency
GC = Gas Chromatography
HCl = Hydrogen Chloride
NO_X = Nitrogen Oxides
OGI = Oregon Graduate Institute
PM_{10} = Particulate Matter less than 10 microns
SO_2 = Sulfur Dioxide
SVOC = Semivolatile Organic Compound
TSP = Total Suspended Particulates
VOC = Volatile Organic Compound

VOCs. Samples for the determination of VOCs were collected and analyzed using procedures based on appropriate sections of EPA Compendium Method TO-14. Sample gas was collected in evacuated stainless steel SUMMA® canisters. Identical canisters were used for each test run. VOCs were quantitatively determined for the VOC analytes listed in Appendix I-A using gas chromatography (GC) with multiple detectors. In addition, total nonspeciated VOCs were determined using appropriate sections of EPA Compendium Method TO-12. The tables in Appendix II-E include duplicate values for those compounds that are common for Method TO-14 and TO-12.

SVOCs. A PS-1 sampler was used to measure SVOCs based on the procedure in EPA Compendium Method TO-13. Sorbent cartridges for the determination of SVOCs in air were analyzed based on SW-846 Method 8270. The samples were collected using a combination quartz filter/adsorbent cartridge. The cartridge contained XAD-2 polymeric resin beads. After sampling, the filters and adsorbent cartridge were extracted with the appropriate solvent(s). The effluent was analyzed by GC equipped with mass spectrometry detection. Appendix I-A presents the target analytes for this determination.

HCl/Cl_2. Chamber gases were pulled through two sets of impingers in series containing, respectively, dilute sulfuric acid and sodium hydroxide solutions following the procedures in EPA Method 26. The analysis of each solution was made using an ion chromatograph following EPA Method 9057. HCl and Cl_2 were quantified separately since the HCl is trapped by the sulfuric acid, while the Cl_2 passes through the sulfuric acid and is absorbed by the sodium hydroxide. Where applicable, duplicate analyses were averaged. HCl was also measured by a continuous analyzer.

Dioxins/Furans. A modified PS-1 sampler was used to measure dioxins/furans based on the procedure in EPA Compendium Method TO-9. Sorbent cartridges for the determination of dioxins/furans in air were analyzed based on SW-846 Method 8290. The samples were collected using a quartz filter and adsorbent cartridge. The cartridge contained XAD-2 resin sandwiched between polyurethane foam (PUF) plugs. After sampling, the filters and adsorbent cartridge were extracted with the appropriate solvent(s). The effluent was analyzed by GC equipped with mass spectrometry detection. Individual isomer results were used to calculate a toxicity equivalence based only on those compounds detected. Appendix I-A presents the target analytes for this determination.

CEM. Real-time concentrations of CO, CO_2, HCl, NO_x, and SO_2 were collected via a CEM system. The detonation gases were sampled for CO using a nondispersive infrared analyzer, for CO_2 using an infrared analyzer, for HCl using a gas filter correlation HCl analyzer, and for NO_x using a chemiluminescent NO-nitrogen dioxide gas analyzer. CO sampling was conducted in accordance with 40 CFR 60, Appendix A, Method 10 with an API 300 CO real-time analyzer. CO_2 sampling was conducted in accordance with 40 CFR 60, Appendix A, Method 3A with a TECO Model 41 CO_2 real-time analyzer. HCl was monitored using a TECO Model 15C HCl real-time analyzer. NO_x sampling was conducted in accordance with 40 CFR 60, Appendix A, Method 7E with an API 200 NO_x real-time analyzer. SO_2 sampling was conducted in accordance with 40 CFR 60, Appendix A, Method 6C.

3. SUMMARY OF SAMPLING RESULTS

This section summarizes the air sampling results from the AEC training ordnance BangBox tests. Complete results are presented in the appendices of this volume.

3.1 Air Sampling Results Summary

The test approach utilized replicate sampling equipment, which is discussed in Section 2.0, to collect samples for the analysis of TSP, PM_{10}, metals, VOC and tracer, SVOC, HCl/Cl_2, dioxin/furan, and CEM data. For those situations where the same analytes were detected in each sampling train, the results were averaged to develop a single concentration. If an analyte was detected in one sample but not detected in the duplicate sampling train, only the values above the detection limit were used (i.e., the nondetect results were not used). Duplicate analyses for a component in a sampling train (e.g., duplicate lead analyses of a TSP sample) were averaged. Analyte lists containing the target compounds are provided in Appendix I-A. Additional tables are provided in Volume II in Appendices II-C through II-I, which list the results for all compounds that were targeted. Analytes that were reported below their specific detection limits are listed as "ND." Volumes III, IV, and V present the analytical data. A chain-of-custody sheet is provided in each volume to correlate field sample identifiers with each respective trial and data run.

The results from the individual test runs were compared with each other for consistency. Test series where more than one trial was completed were averaged. Average values were used to summarize the resulting emissions and to determine the emission factors. An average sample value (in parts per billion by volume or mg/m^3) was determined for each target analyte expressed at a standard pressure of 29.92 in. Hg and standard temperature of 68°F.

Background measurements for all target compounds were made each day (without deploying an item) and for VOCs prior to each test run. It should be noted that for the CEM data (in Appendix II-I), the background concentration is the concentration in the chamber prior to the training ordnance deployment. The test concentration data are the average during sampling (from deployment of the item until the test is completed). Both field and reagent blanks were collected during field testing. Field blanks were treated as an actual sample. Field blanks were collected by assembling and recovering one complete sampling system that was in the field but without a gaseous sample being passed through the sampling train. A reagent blank was also collected for each sampling train component.

Replicate runs were performed for the items with a higher priority for testing. These were the Simulator Flash Artillery, Simulator Hand Grenade, and Simulator Ground Burst. The variability between runs was briefly examined. The measured variation in TSP, PM_{10}, and NO_x was within 10% for the two runs for the Simulator Hand Grenade and the Simulator Ground Burst. This is within the measurement accuracy of the methods. However, these measurements varied 15 to 30% for the Simulator Flash Artillery. This indicates that there is variability in emissions produced for certain items.

The SVOC measurements included two sample collection procedures for those items with replicate runs (Simulator Flash Artillery, Simulator Hand Grenade, and Simulator Ground Burst). One set of samples (standard) was collected using one filter and one XAD cartridge

for each run. For the second set of samples (composite), a clean filter was used with the same XAD cartridge for the replicate run. The two filters and composite XAD were analyzed as a single sample. The values from the composite samples were similar to the standard samples, although some high bias was observed in the composite samples for some compounds. Based on a brief examination, the positive bias was not significant and was within the expected variation of the method.

The BangBox is not airtight and is kept inflated by a fan. Some gas escapes through small leaks in the structure. A tracer gas (SF_6) was released into the BangBox during each test run, and the SF_6 concentration was measured during sampling. The purpose of the tracer measurements are to provide data that are used to quantity dilution due to air infiltration. Since the quantity of SF_6 was known, it was possible to determine the initial detonation plume volume and to "correct" sample concentrations for dilution. Appendix II-B in Volume II provides the tracer data and the initial plume fraction sampled for the TSP, PM_{10}, metals, SVOC, HCl/Cl_2, dioxin/furan, CEM, and VOC data. A substantial portion of the plume was sampled in all test series. All the dilution correction factors were greater than 80% except for Simulator Flash Artillery M110 Run No. 1 (78.87%).

3.2 Emission Factor Results Summary

Average emission factors (pounds compound per item) were developed for each detected compound. Each emission factor was calculated by dividing the measured mass in the plume by the number of items deployed. Average emission factors were also calculated by dividing the measured mass in the plume by the net explosive weight (NEW).

Since many of the compounds measured may be present in ambient air, "corrected" emission factors were determined by subtracting the background concentrations. The emission factors were also adjusted (using the tracer data for each run) to compensate for dilution that occurred during sampling. The measured actual and background concentrations and corrected emission factors for representative detected compounds are summarized in Tables 4 through 11 for TSP, PM_{10}, metals, HCl/Cl_2, dioxins/furans, CEM data, VOCs, and SVOCs for each item. Both of the calculated emission factors for all compounds measured are provided in the summary tables in Appendix I-B. The spreadsheets in Appendix II-A (Volume II) contain the sample input parameters, measured concentrations background and blank data, and corrected and uncorrected emission factors for each run. The sample calculations in Appendix 1-C also show the basis for the column headings in the tables and spreadsheets.

Some of the compounds measured were obviously products of the detonation. Others were measured at similar concentrations in the background sample or were reported near the analytical detection limit. The following categories were developed to "qualify" the reliability of the calculated emission factors.

A. Detonation compound. This category includes compounds measured at >10 times the background level or detection limit.

B. Likely detonation compound. This category includes compounds measured at <10 and >5 times the background level or detection limit.

Table 4. Representative Simulator Booby Trap Flash M117 Emission Factors

Compound	Measured[a] Actual Concentration (mg/m^3)	Measured[a] Background Concentration (mg/m^3)	Theoretical[b] Emission Factor (lb/item)	Average[c] Adjusted Emission Factor (lb/item)	Notes
TSP	3.056E+01	8.255E-02	NA	2.872E-03	Essentially PM_{10}
Sulfur Dioxide (SO_2)	4.233E+00	1.598E-03	1.652E-03	3.987E-04	
Carbon Monoxide (CO)	7.180E-01	1.403E-01	NA	5.444E-05	
Nitrogen Oxide (NO_x)	4.954E-01	1.860E-02	NA	4.492E-05	
Hydrogen Chloride (HCl)	ND	ND	8.202E-04	ND	See Note 1
Metals					
Aluminum	8.785E-02	NM[d]	NA	8.279E-06	See Note 2
Antimony	8.363E+00	NM[d]	8.00E-05	7.881E-04	
Barium	1.406E-03	NM[d]	NA	1.325E-07	See Note 2
Cadmium	6.546E-05	NM[d]	NA	6.169E-09	See Note 2
Chromium	1.415E-03	NM[d]	NA	1.333E-07	See Note 2
Cobalt	8.600E-05	NM[d]	NA	8.103E-09	See Note 2
Lead	2.167E-02	NM[d]	NA	2.042E-06	See Note 2
Magnesium	1.819E+00	NM[d]	3.23E-05	1.714E-04	
Manganese	3.955E-03	NM[d]	NA	3.726E-07	See Note 2
Phosphorus	2.264E-01	NM[d]	2.48E-05	2.133E-05	
Volatile Organic Compounds (VOCs)[e]					
TNMHC	9.070E-02	4.600E-02	NA	3.811E-06	
Acetylene	1.255E-03	3.200E-03	NA	7.971E-07	
Benzene	4.750E-03	7.000E-04	NA	3.453E-07	
Carbon Disulfide	3.460E-02	1.143E-03	NA	2.852E-06	
Ethylene	8.250E-03	2.600E-03	NA	4.817E-07	
Methylene Chloride	5.830E-03	4.948E-04	NA	4.548E-07	
Toluene	3.000E-03	8.000E-04	NA	1.876E-07	
Semivolatile Organic Compounds (SVOCs)					
2-Methylnaphthalene	ND	ND	NA	ND	
Acetophenone	3.623E-04	2.808E-04	NA	7.682E-09	
Butylbenzylphthalate	3.242E-04	ND	NA	3.055E-08	
Di-n-butylphthalate	1.436E-03	7.766E-04	NA	6.214E-08	
Diethylphthalate	2.532E-04	4.340E-04	NA	ND	See Note 3
Naphthalene	3.006E-04	ND	NA	2.832E-08	

NA = Not applicable
ND = Nondetect
NM = Not measurable
[a]These values represent concentrations that were measured only and have not been corrected for plume dilution.
[b]These values represent theoretical mass balance calculations based on the molecular quantity found in the database for the munition item.
[c]These values represent measured mass in the plume less background and corrected for dilution based on the initial tracer concentrations.
[d]Insufficient material to analyze.
[e]These are VOCs that are common to all eight munition items tested. A complete listing of detected compounds that are present is provided in Appendix I-B and II-A.
Note 1: HCl/Cl_2 levels too low to be reliably measured.
Note 2: Not an expected compound based on database constituents. Database may not provide a complete analysis of the content of the item.
Note 3: Not a munition item compound, concentrations higher in background.

Table 5. Representative Simulator Flash Artillery M110 Emission Factors

Compound	Measured[a] Actual Concentration (mg/m³)	Measured[a] Background Concentration (mg/m³)	Theoretical[b] Emission Factor (lb/item)	Average[c] Adjusted Emission Factor (lb/item)	Notes
TSP	1.939E+01	ND	NA	5.082E-02	Essentially PM_{10}
Sulfur Dioxide (SO_2)	5.675E-02	1.833E-04	5.26E-05	1.455E-04	
Carbon Monoxide (CO)	2.524E+00	1.385E-01	NA	6.270E-03	
Nitrogen Oxide (NO_x)	7.375E-01	4.064E-02	NA	1.816E-03	
Hydrogen Chloride (HCl)	7.503E-02	ND	1.73E-02	ND	See Note 1
Metals					
Aluminum	1.076E-01	NM[d]	NA	2.824E-04	See Note 2
Antimony	1.515E-02	NM[d]	NA	4.002E-05	See Note 2
Barium	1.168E+00	NM[d]	1.82E-02	3.057E-03	
Cadmium	1.056E-04	NM[d]	NA	2.744E-07	See Note 2
Chromium	2.906E-03	NM[d]	NA	7.598E-06	See Note 2
Cobalt	3.293E-04	NM[d]	NA	8.613E-07	See Note 2
Lead	3.693E-03	NM[d]	NA	9.672E-06	See Note 2
Magnesium	5.400E+00	NM[d]	8.43E-02	1.424E-02	
Manganese	4.337E-03	NM[d]	NA	1.133E-05	See Note 2
Phosphorus	2.107E-03	NM[d]	NA	5.486E-06	See Note 2
Volatile Organic Compounds (VOCs)[e]					
TNMHC	2.267E+00	1.760E-01	NA	4.871E-03	
Acetylene	7.800E-03	7.500E-04	NA	1.640E-05	
Benzene	8.735E-02	3.100E-03	NA	1.963E-04	
Carbon Disulfide	8.522E-03	5.882E-04	NA	1.843E-05	
Ethylene	2.045E-02	3.000E-04	NA	4.688E-05	
Methylene Chloride	8.685E-03	9.779E-04	NA	1.796E-05	
Toluene	2.225E-01	1.890E-02	NA	4.739E-04	
Semivolatile Organic Compounds (SVOCs)					
2-Methylnaphthalene	1.074E-02	ND	NA	2.804E-05	
Acetophenone	ND	1.786E-04	NA	ND	
Butylbenzylphthalate	ND	ND	NA	ND	
Di-n-butylphthalate	7.337E-04	1.615E-03	NA	ND	See Note 3
Diethylphthalate	9.944E-05	2.247E-04	NA	ND	See Note 3
Naphthalene	2.487E-02	ND	NA	6.512E-05	

NA = Not applicable
ND = Nondetect
NM = Not measurable
[a]These values represent concentrations that were measured only and have not been corrected for plume dilution.
[b]These values represent theoretical mass balance calculations based on the molecular quantity found in the database for the munition item.
[c]These values represent measured mass in the plume less background and corrected for dilution based on the initial tracer concentrations.
[d]Insufficient material to analyze.
[e]These are VOCs that are common to all eight munition items tested. Other compounds measured at higher levels for this item. A complete listing of detected compounds that are present is provided in Appendix I-B and II-A.
Note 1: HCl/Cl_2 levels too low to be reliably measured.
Note 2: Not an expected compound based on database constituents. Database may not provide a complete analysis of the content of the item.
Note 3: Not a munition item compound, concentrations higher in background.

Table 6. Representative Simulator Hand Grenade Emission Factors

Compound	Measured[a] Actual Concentration (mg/m³)	Measured[a] Background Concentration (mg/m³)	Theoretical[b] Emission Factor (lb/item)	Average[c] Adjusted Emission Factor (lb/item)	Notes
TSP	1.424E+02	ND	NA	8.619E-02	Essentially PM_{10}
Sulfur Dioxide (SO_2)	6.450E-01	ND	5.04E-06	4.510E-04	
Carbon Monoxide (CO)	3.871E-01	2.252E-02	NA	3.986E-03	
Nitrogen Oxide (NO_x)	7.996E+00	3.925E-02	NA	5.431E-03	
Hydrogen Chloride (HCl)	ND	ND	2.15E-03	ND	See Note 1
Metals					
Aluminum	1.408E+01	NM[d]	5.28E-03	8.507E-03	
Antimony	2.507E-02	NM[d]	NA	1.590E-05	See Note 2
Barium	4.949E-02	NM[d]	NA	2.983E-05	See Note 2
Cadmium	2.907E-04	NM[d]	NA	1.754E-07	See Note 2
Chromium	7.877E-04	NM[d]	NA	4.750E-07	See Note 2
Cobalt	4.251E-04	NM[d]	NA	2.570E-07	See Note 2
Lead	1.782E-03	NM[d]	NA	1.079E-06	See Note 2
Magnesium	1.673E+01	NM[d]	6.91E-03	1.011E-02	
Manganese	1.585E-02	NM[d]	NA	9.581E-06	See Note 2
Phosphorus	1.964E-02	NM[d]	1.07E-05	1.182E-05	
Volatile Organic Compounds (VOCs)[e]					
TNMHC	9.160E-02	2.310E-02	NA	4.159E-05	
Acetylene	1.295E-02	9.500E-04	NA	7.294E-06	
Benzene	2.950E-03	5.500E-04	NA	1.459E-06	
Carbon Disulfide	8.951E-02	6.089E-04	NA	5.428E-05	
Ethylene	1.275E-02	1.500E-04	NA	7.653E-06	
Methylene Chloride	6.838E-03	6.733E-04	NA	3.816E-06	
Toluene	1.600E-03	5.000E-04	NA	6.698E-07	
Semivolatile Organic Compounds (SVOCs)					
2-Methylnaphthalene	2.530E-04	ND	NA	1.612E-07	
Acetophenone	6.209E-04	1.897E-04	NA	2.735E-07	
Butylbenzylphthalate	1.489E-03	ND	NA	9.417E-07	
Di-n-butylphthalate	3.892E-03	ND	NA	2.444E-06	
Diethylphthalate	2.007E-04	ND	NA	1.278E-07	
Naphthalene	6.122E-04	ND	NA	3.879E-07	

NA = Not applicable
ND = Nondetect
NM = Not measurable
[a]These values represent concentrations that were measured only and have not been corrected for plume dilution.
[b]These values represent theoretical mass balance calculations based on the molecular quantity found in the database for the munition item.
[c]These values represent measured mass in the plume less background and corrected for dilution based on the initial tracer concentrations.
[d]Insufficient material to analyze.
[e]These are VOCs that are common to all eight munition items tested. A complete listing of detected compounds that are present is provided in Appendix I-B and II-A.
Note 1: HCl/Cl_2 levels too low to be reliably measured.
Note 2: Not an expected compound based on database constituents. Database may not provide a complete analysis of the content of the item.

Table 7. Representative Simulator Ground Burst Emission Factors

Compound	Measured[a] Actual Concentration (mg/m³)	Measured[a] Background Concentration (mg/m³)	Theoretical[b] Emission Factor (lb/item)	Average[c] Adjusted Emission Factor (lb/item)	Notes
TSP	9.907E+01	ND	NA	1.064E-01	Essentially PM_{10}
Sulfur Dioxide (SO_2)	1.184E-01	ND	5.63E-05	2.654E-04	
Carbon Monoxide (CO)	2.080E+00	2.687E-01	NA	4.057E-03	
Nitrogen Oxide (NO_x)	4.973E+00	3.974E-02	NA	1.008E-02	
Hydrogen Chloride (HCl)	7.324E-02	ND	9.05E-03	ND	See Note 1
Metals					
Aluminum	1.749E+01	NM[d]	2.44E-02	1.770E-02	
Antimony	2.558E-02	NM[d]	NA	2.579E-05	See Note 2
Barium	5.871E-02	NM[d]	NA	5.871E-05	See Note 2
Cadmium	3.575E-04	NM[d]	NA	3.608E-07	See Note 2
Chromium	1.107E-03	NM[d]	NA	1.113E-06	See Note 2
Cobalt	5.423E-04	NM[d]	NA	5.541E-07	See Note 2
Lead	3.726E-03	NM[d]	NA	3.808E-06	See Note 2
Magnesium	2.075E+01	NM[d]	NA	2.104E-02	See Note 2
Manganese	3.277E-02	NM[d]	NA	3.399E-05	See Note 2
Phosphorus	5.897E-02	NM[d]	1.71E-05	6.081E-05	
Volatile Organic Compounds (VOCs)[e]					
TNMHC	1.580E-01	2.165E-02	NA	1.271E-04	
Acetylene	4.445E-02	7.000E-04	NA	4.033E-05	
Benzene	9.900E-03	5.500E-04	NA	8.696E-06	
Carbon Disulfide	5.496E-02	4.533E-04	NA	5.059E-05	
Ethylene	3.545E-02	1.000E-04	NA	3.239E-05	
Methylene Chloride	8.883E-03	3.194E-04	NA	8.855E-06	
Toluene	2.500E-03	6.000E-04	NA	1.784E-06	
Semivolatile Organic Compounds (SVOCs)					
2-Methylnaphthalene	3.538E-04	ND	NA	4.140E-07	
Acetophenone	6.804E-04	1.897E-04	NA	5.907E-07	
Butylbenzylphthalate	1.781E-03	ND	NA	2.158E-06	
Di-n-butylphthalate	2.408E-03	ND	NA	2.925E-06	
Diethylphthalate	2.278E-04	ND	NA	2.665E-07	
Naphthalene	1.146E-03	ND	NA	1.382E-06	

NA = Not applicable
ND = Nondetect
NM = Not measurable
[a]These values represent concentrations that were measured only and have not been corrected for plume dilution.
[b]These values represent theoretical mass balance calculations based on the molecular quantity found in the database for the munition item.
[c]These values represent measured mass in the plume less background and corrected for dilution based on the initial tracer concentrations.
[d]Insufficient material to analyze.
[e]These are VOCs that are common to all eight munition items tested. A complete listing of detected compounds that are present is provided in Appendix I-B and II-A.

Note 1: HCl/Cl_2 levels too low to be reliably measured.
Note 2: Not an expected compound based on database constituents. Database may not provide a complete analysis of the content of the item.

Table 8. Representative Green Star Cluster Signal Flare Emission Factors

Compound	Measured[a] Actual Concentration (mg/m³)	Measured[a] Background Concentration (mg/m³)	Theoretical[b] Emission Factor (lb/item)	Average[c] Adjusted Emission Factor (lb/item)	Notes
TSP	3.072E+01	3.893E-02	NA	7.508E-02	Essentially PM_{10}
Sulfur Dioxide (SO_2)	2.268E-03	2.445E-03	5.53E-03	ND	See Note 1
Carbon Monoxide (CO)	4.242E+00	2.661E-01	NA	9.689E-03	
Nitrogen Oxide (NO_x)	6.984E-01	4.099E-02	NA	1.602E-03	
Hydrogen Chloride (HCl)	7.165E-02	ND	2.97E-03	ND	See Note 2
Metals					
Aluminum	1.011E-02	NM[d]	7.71E-06	2.473E-05	
Antimony	5.252E-04	NM[d]	1.38E-05	1.285E-06	
Barium	5.109E-01	NM[d]	8.03E-03	1.250E-03	
Cadmium	3.421E-05	NM[d]	NA	8.372E-08	See Note 3
Chromium	2.643E-03	NM[d]	1.65E-04	6.469E-06	
Cobalt	3.134E-04	NM[d]	9.38E-06	7.668E-07	
Lead	7.961E-04	NM[d]	2.37E-05	1.948E-06	
Magnesium	3.118E+00	NM[d]	1.03E-02	7.631E-03	
Manganese	6.595E-03	NM[d]	NA	1.614E-05	See Note 3
Phosphorus	2.547E-03	NM[d]	NA	6.232E-06	See Note 3
Volatile Organic Compounds (VOCs)[e]					
TNMHC	1.486E-01	3.600E-02	NA	2.535E-04	
Acetylene	2.570E-02	8.000E-04	NA	5.606E-05	
Benzene	8.500E-03	1.000E-03	NA	1.689E-05	
Carbon Disulfide	9.335E-03	1.684E-03	NA	1.723E-05	
Ethylene	2.380E-02	2.000E-04	NA	5.313E-05	
Methylene Chloride	4.153E-02	2.283E-04	NA	9.298E-05	
Toluene	4.300E-03	2.200E-03	NA	4.728E-06	
Semivolatile Organic Compounds (SVOCs)					
2-Methylnaphthalene	2.725E-04	ND	NA	6.669E-07	
Acetophenone	5.830E-04	2.708E-04	NA	7.641E-07	
Butylbenzylphthalate	ND	ND	NA	ND	
Di-n-butylphthalate	1.302E-03	1.357E-03	NA	ND	See Note 1
Diethylphthalate	8.956E-04	3.475E-04	NA	1.342E-06	
Naphthalene	6.994E-04	2.995E-04	NA	9.786E-07	

NA = Not applicable
ND = Nondetect
NM = Not measurable
[a]These values represent concentrations that were measured only and have not been corrected for plume dilution.
[b]These values represent theoretical mass balance calculations based on the molecular quantity found in the database for the munition item.
[c]These values represent measured mass in the plume less background and corrected for dilution based on the initial tracer concentrations.
[d]Insufficient material to analyze.
[e]These are VOCs that are common to all eight munition items tested. A complete listing of detected compounds that are present is provided in Appendix I-B and II-A.
Note 1: Not a munition item compound, concentrations higher in background.
Note 2: HCl/Cl_2 levels too low to be reliably measured.
Note 3: Not an expected compound based on database constituents. Database may not provide a complete analysis of the content of the item.

Table 9. Representative Green Parachute Signal Flare Emission Factors

Compound	Measured[a] Actual Concentration (mg/m^3)	Measured[a] Background Concentration (mg/m^3)	Theoretical[b] Emission Factor (lb/item)	Average[c] Adjusted Emission Factor (lb/item)	Notes
TSP	5.503E+01	3.893E-02	NA	1.340E-01	Essentially PM_{10}
Sulfur Dioxide (SO_2)	7.964E-04	ND	1.35E-02	6.430E-05	
Carbon Monoxide (CO)	3.939E+00	5.106E-01	NA	8.350E-03	
Nitrogen Oxide (NO_x)	9.963E-01	1.313E-01	NA	2.107E-03	
Hydrogen Chloride (HCl)	ND	ND	7.27E-02	ND	See Note 1
Metals					
Aluminum	3.827E-02	NM[d]	7.97E-06	9.328E-05	
Antimony	4.842E-04	NM[d]	1.38E-05	1.180E-06	
Barium	3.535E+00	NM[d]	5.55E-02	8.617E-03	
Cadmium	4.751E-04	NM[d]	1.01E-02	1.158E-06	
Chromium	2.984E-03	NM[d]	1.65E-04	7.273E-06	
Cobalt	1.492E-03	NM[d]	NA	3.637E-06	See Note 2
Lead	1.887E-04	NM[d]	2.37E-05	4.599E-07	
Magnesium	1.113E+01	NM[d]	4.80E-02	2.713E-02	
Manganese	4.658E-03	NM[d]	NA	1.135E-05	See Note 2
Phosphorus	4.809E-03	NM[d]	NA	1.172E-05	See Note 2
Volatile Organic Compounds (VOCs)[e]					
TNMHC	1.380E-01	6.070E-02	NA	1.750E-04	
Acetylene	1.390E-02	2.800E-03	NA	2.514E-05	
Benzene	8.050E-03	2.300E-03	NA	1.302E-05	
Carbon Disulfide	9.840E-03	5.277E-04	NA	2.109E-05	
Ethylene	2.605E-02	8.000E-04	NA	5.719E-05	
Methylene Chloride	5.547E-02	8.068E-04	NA	1.238E-04	
Toluene	5.700E-03	5.000E-03	NA	1.585E-06	
Semivolatile Organic Compounds (SVOCs)					
2-Methylnaphthalene	2.645E-04	ND	NA	6.588E-07	
Acetophenone	4.185E-04	2.708E-04	NA	3.679E-07	
Butylbenzylphthalate	ND	ND	NA	ND	
Di-n-butylphthalate	9.726E-04	1.357E-03	NA	ND	See Note 3
Diethylphthalate	2.019E-03	3.475E-04	NA	4.164E-06	
Naphthalene	6.085E-04	2.995E-04	NA	7.694E-07	

NA = Not applicable
ND = Nondetect
NM = Not measurable
[a]These values represent concentrations that were measured only and have not been corrected for plume dilution.
[b]These values represent theoretical mass balance calculations based on the molecular quantity found in the database for the munition item.
[c]These values represent measured mass in the plume less background and corrected for dilution based on the initial tracer concentrations.
[d]Insufficient material to analyze.
[e]These are VOCs that are common to all eight munition items tested. A complete listing of detected compounds that are present is provided in Appendix I-B and II-A.
Note 1: HCl/Cl_2 levels too low to be reliably measured.
Note 2: Not an expected compound based on database constituents. Database may not provide a complete analysis of the content of the item.
Note 3: Not a munition item compound, concentrations higher in background.

Table 10. Representative White Parachute Signal Flare Emission Factors

Compound	Measured[a] Actual Concentration (mg/m³)	Measured[a] Background Concentration (mg/m³)	Theoretical[b] Emission Factor (lb/item)	Average[c] Adjusted Emission Factor (lb/item)	Notes
TSP	8.628E+01	3.893E-02	NA	2.079E-01	Essentially PM_{10}
Sulfur Dioxide (SO_2)	6.342E-02	1.801E-03	6.77E-03	1.527E-04	
Carbon Monoxide (CO)	2.159E+00	2.190E-01	NA	4.807E-03	
Nitrogen Oxide (NO_x)	2.667E+00	1.668E-01	NA	6.195E-03	
Hydrogen Chloride (HCl)	ND	ND	3.78E-05	ND	See Note 1
Metals					
Aluminum	1.064E-02	NM[d]	7.71E-06	2.566E-05	
Antimony	7.467E-04	NM[d]	1.38E-05	1.800E-06	
Barium	4.227E-02	NM[d]	4.79E-04	1.019E-04	
Cadmium	5.957E-05	NM[d]	NA	1.436E-07	See Note 2
Chromium	3.570E-03	NM[d]	1.65E-04	8.607E-06	
Cobalt	1.231E-04	NM[d]	3.75E-05	2.967E-07	
Lead	2.607E-03	NM[d]	2.37E-05	6.285E-06	
Magnesium	1.144E+01	NM[d]	1.24E-01	2.757E-02	
Manganese	1.497E-02	NM[d]	NA	3.608E-05	See Note 2
Phosphorus	5.157E-03	NM[d]	NA	1.243E-05	See Note 2
Volatile Organic Compounds (VOCs)[e]					
TNMHC	1.344E-01	9.740E-02	NA	8.493E-05	
Acetylene	7.300E-03	4.500E-03	NA	6.436E-06	
Benzene	7.500E-03	3.400E-03	NA	9.424E-06	
Carbon Disulfide	9.263E-03	5.646E-04	NA	1.999E-05	
Ethylene	1.195E-02	2.800E-03	NA	2.103E-05	
Methylene Chloride	3.336E-03	1.287E-03	NA	4.709E-06	
Toluene	8.550E-03	7.800E-03	NA	1.726E-06	
Semivolatile Organic Compounds (SVOCs)					
2-Methylnaphthalene	ND	ND	NA	ND	
Acetophenone	5.510E-04	2.708E-04	NA	7.159E-07	
Butylbenzylphthalate	ND	ND	NA	ND	
Di-n-butylphthalate	3.134E-03	1.357E-03	NA	4.541E-06	
Diethylphthalate	5.907E-04	3.475E-04	NA	6.216E-07	
Naphthalene	4.426E-04	2.995E-04	NA	3.655E-07	

NA = Not applicable
ND = Nondetect
NM = Not measurable
[a]These values represent concentrations that were measured only and have not been corrected for plume dilution.
[b]These values represent theoretical mass balance calculations based on the molecular quantity found in the database for the munition item.
[c]These values represent measured mass in the plume less background and corrected for dilution based on the initial tracer concentrations.
[d]Insufficient material to analyze.
[e]These are VOCs that are common to all eight munition items tested. A complete listing of detected compounds that are present is provided in Appendix I-B and II-A.

Note 1: HCl/Cl_2 levels too low to be reliably measured.
Note 2: Not an expected compound based on database constituents. Database may not provide a complete analysis of the content of the item.

Table 11. Representative 155mm Illumination Round Emission Factors

Compound	Measured[a] Actual Concentration (mg/m³)	Measured[a] Background Concentration (mg/m³)	Theoretical[b] Emission Factor (lb/item)	Average[c] Adjusted Emission Factor (lb/item)	Notes
TSP	1.163E+03	ND	NA	2.598E+00	Essentially PM_{10}
Sulfur Dioxide (SO_2)	1.064E+00	7.430E-04	5.154E-02	2.571E-03	
Carbon Monoxide (CO)	1.026E+01	2.826E-01	NA	2.414E-02	
Nitrogen Oxide (NO_x)	3.619E+01	1.737E-02	NA	8.750E-02	
Hydrogen Chloride (HCl)	4.549E-01	3.844E-01	1.330E-02	1.704E-04	See Note 1
Metals					
Aluminum	1.960E-01	NM[d]	NA	4.381E-04	See Note 2
Antimony	1.150E-02	NM[d]	NA	2.570E-05	See Note 2
Barium	2.121E-01	NM[d]	3.29E-02	4.740E-04	
Cadmium	4.037E-02	NM[d]	NA	9.022E-05	See Note 2
Chromium	3.776E-03	NM[d]	2.78E-04	8.441E-06	
Cobalt	1.028E-03	NM[d]	NA	2.297E-06	See Note 2
Lead	3.188E-02	NM[d]	9.89E-04	7.125E-05	
Magnesium	7.880E+01	NM[d]	2.85E+00	1.761E-01	
Manganese	2.958E-02	NM[d]	1.22E-03	6.611E-05	
Phosphorus	3.234E-02	NM[d]	NA	7.229E-05	See Note 2
Volatile Organic Compounds (VOCs)[e]					
TNMHC	7.089E-01	3.620E-02	NA	1.524E-03	
Acetylene	1.140E-01	7.000E-04	NA	2.567E-04	
Benzene	4.770E-02	1.100E-03	NA	1.056E-04	
Carbon Disulfide	2.962E-02	1.418E-03	NA	6.388E-05	
Ethylene	1.243E-02	2.000E-04	NA	2.811E-04	
Methylene Chloride	7.081E-01	2.044E-03	NA	1.599E-03	
Toluene	1.360E-02	3.000E-03	NA	2.401E-05	
Semivolatile Organic Compounds (SVOCs)					
2-Methylnaphthalene	ND	ND	NA	ND	
Acetophenone	2.883E-03	2.071E-04	NA	6.038E-06	
Butylbenzylphthalate	3.028E-03	ND	NA	6.833E-06	
Di-n-butylphthalate	4.077E-03	7.691E-04	NA	7.465E-06	
Diethylphthalate	1.776E-03	1.381E-04	NA	3.697E-06	
Naphthalene	5.579E-03	ND	NA	1.259E-05	

NA = Not applicable
ND = Nondetect
NM = Not measurable
[a]These values represent concentrations that were measured only and have not been corrected for plume dilution.
[b]These values represent theoretical mass balance calculations based on the molecular quantity found in the database for the munition item.
[c]These values represent measured mass in the plume less background and corrected for dilution based on the initial tracer concentrations.
[d]Insufficient material to analyze.
[e]These are VOCs that are common to all eight munition items tested. A complete listing of detected compounds that are present is provided in Appendix I-B and II-A.

Note 1: HCl/Cl_2 levels too low to be reliably measured.
Note 2: Not an expected compound based on database constituents. Database may not provide a complete analysis of the content of the item.

C. Probable detonation compound. This category includes compounds measured at <5 and >2 times the background level or detection limit.

D. Possible detonation compound. Compound was measured, but its presence as a detonation compound is questionable and its magnitude is difficult to quantify. This category includes compounds measured at <2 times and >1 times (but above) the background level or detection limit.

F. Not a detonation compound. This category includes compound measured at <1 times (but above) the background level or detection limit.

The data qualifiers are designed to help the user of the emission factors be aware of the general reliability of the data. While all emission factors are considered valid (except those with an "F"), based on the method of calculation, the level of confidence is reduced if the measured concentrations are only slightly above the background or detection limit concentrations. All measured compounds and their data qualifiers are listed in Appendix II-A (Volume II).

Figures 3 to 7 provide a comparison of the emission factor results among training items. This comparison provides additional information into the emission factor results. The calculated emission factors are "normalized" based on the NEW of each training ordnance. This approach allows comparison of emissions produced per unit of energetic material. Direct comparison of emissions between items is meaningless because they very widely in energetic content.

Figure 3 compares TSP, PM_{10}, CO, NO_x, SO_2, and CO_2 for all eight tests. The tables in Appendix II-C and II-I (Volume II) summarize the TSP, PM_{10}, and CEM data, respectively, for all eight training ordnance munition items. TSP and PM_{10} were the primary compounds emitted. The highest emission factor results for TSP and PM_{10} were for the Simulator Hand Grenade. The lowest were from the Green Star Cluster. There was considerable variation in the CO emission factors and even more with NO_x. The highest NO_x emission factors were with the Simulator Hand Grenade and the Simulator Ground Burst. By contrast, the NO_x emission factor for the Green Star Cluster was only about 1.5% that level. SO_2 varied with the amount of sulfur in the item. The relatively high CO_2 emission factor for the Simulator Artillery Flash M110 reflects the gasoline component of that item.

Eighteen of the nineteen target metals were found in the TSP generated during one or more test runs. The results of the training ordnance metals analyses are included in Appendix II-D for each test. All metals data emission factors are shown in Appendix I-B and II-A. Figure 4 shows the comparison data for metals. The higher levels of aluminum, antimony, barium, magnesium, and phosphorus in some items correspond to enriched levels of those compounds in the items (see Table 2). Metals added for pyrotechnic effect like magnesium or aluminum make up 5–30% of the particulate material for some items.

Data for each munition item were examined to determine the theoretical metal emission factor for each metal known to be present in the ordnance. The theoretical emission factors are calculated based on constituent data from MIDAS. MIDAS is an extensive database that lists the components, parts, materials, and bulk items for more than 3,000 munitions. The database was assembled using the best available technical data, engineering

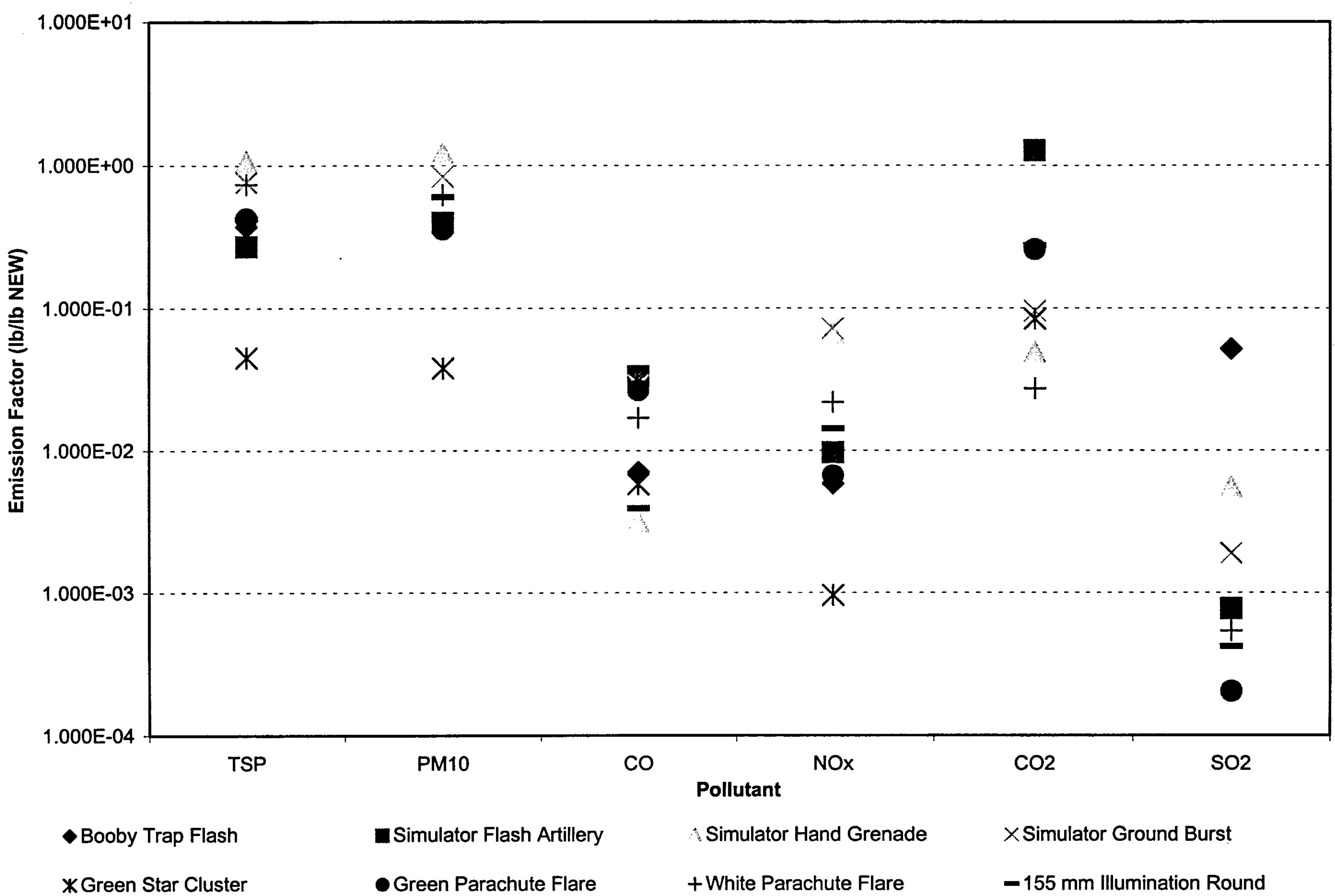

Figure 3. TSP, PM_{10}, and CEM System Emission Factors for AEC Training Ordnance

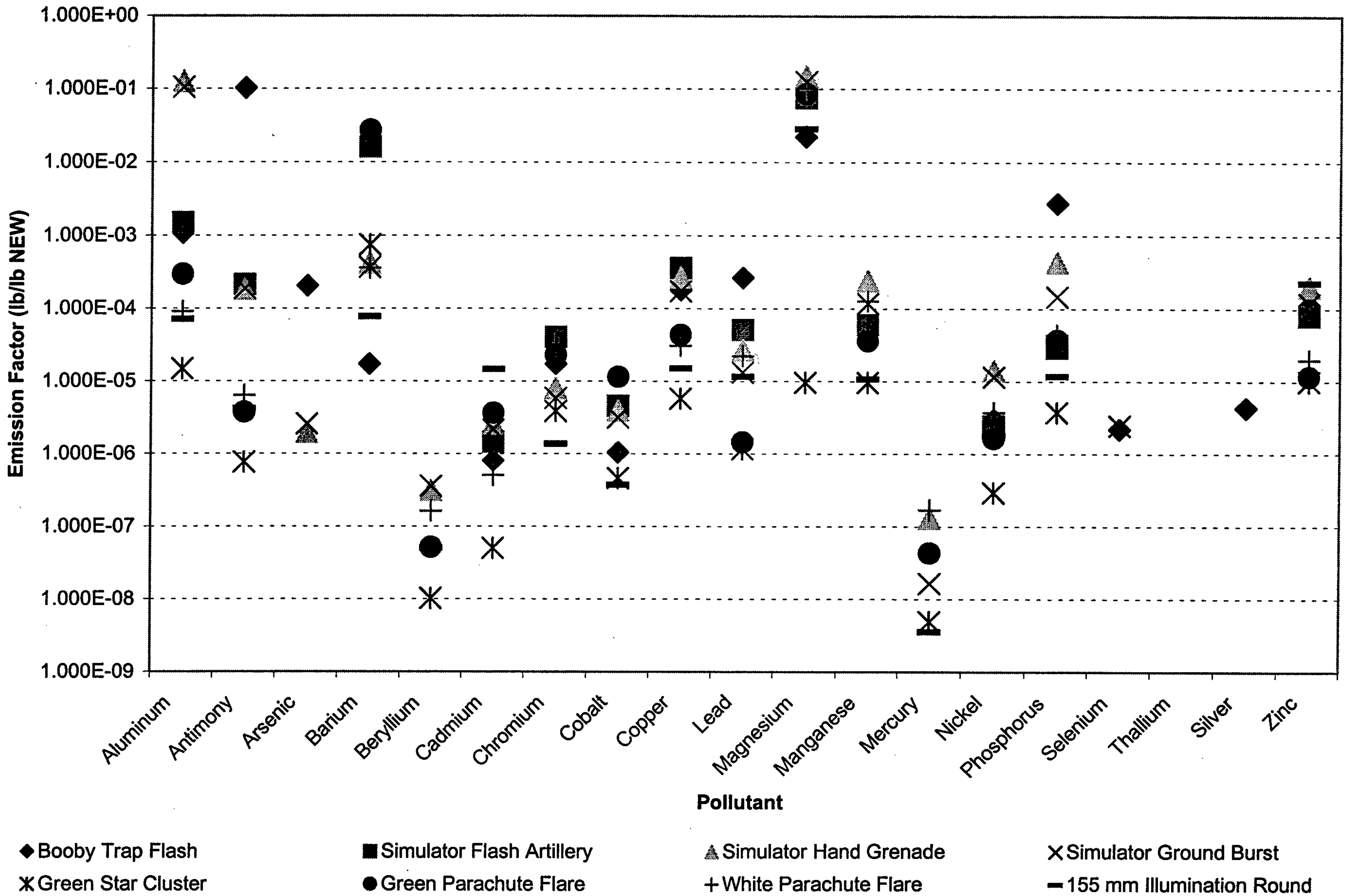

Figure 4. Metals Emission Factors for AEC Training Ordnance

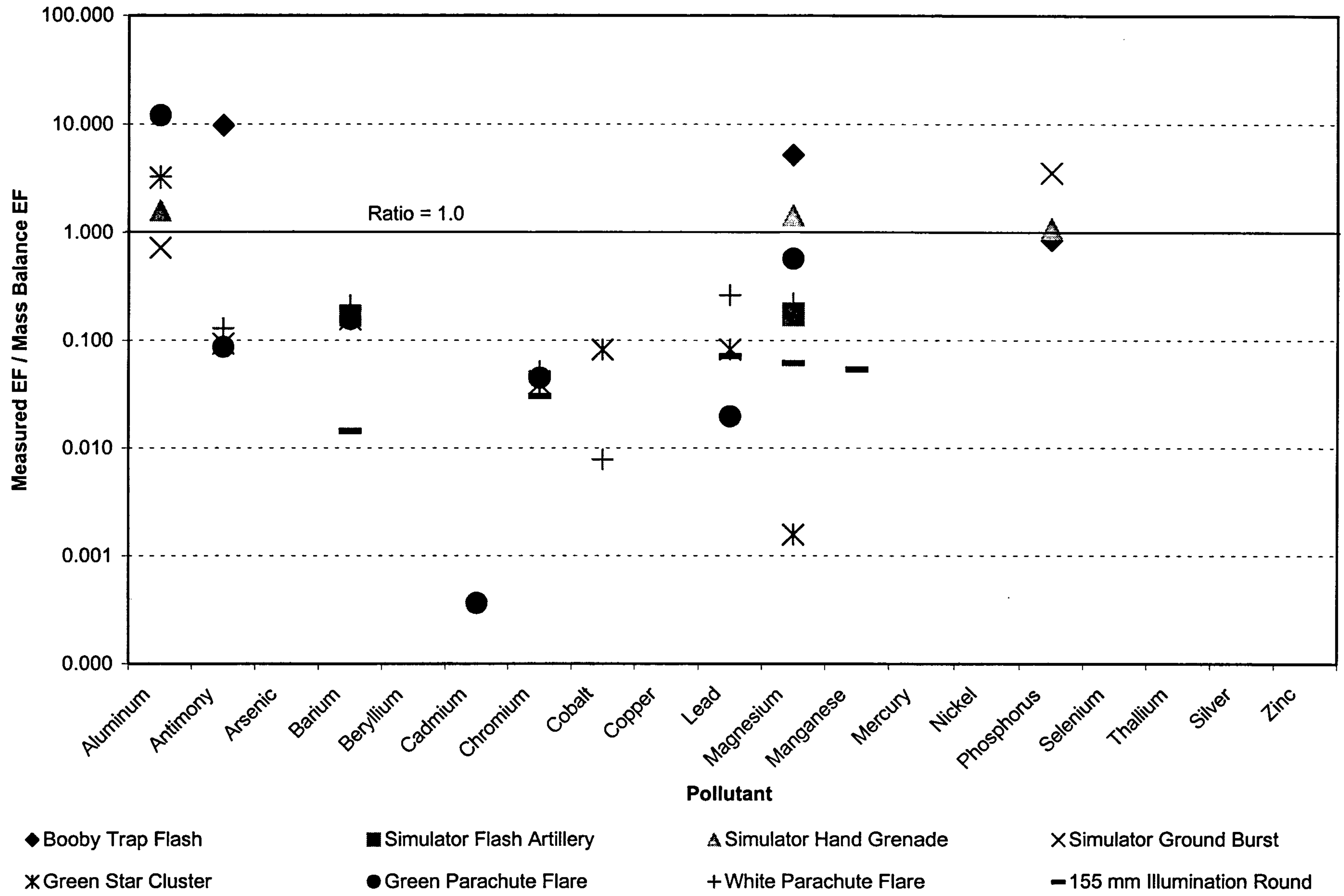

Figure 5. Metals Emission Factor Comparison for Measured vs. Theoretical Emissions

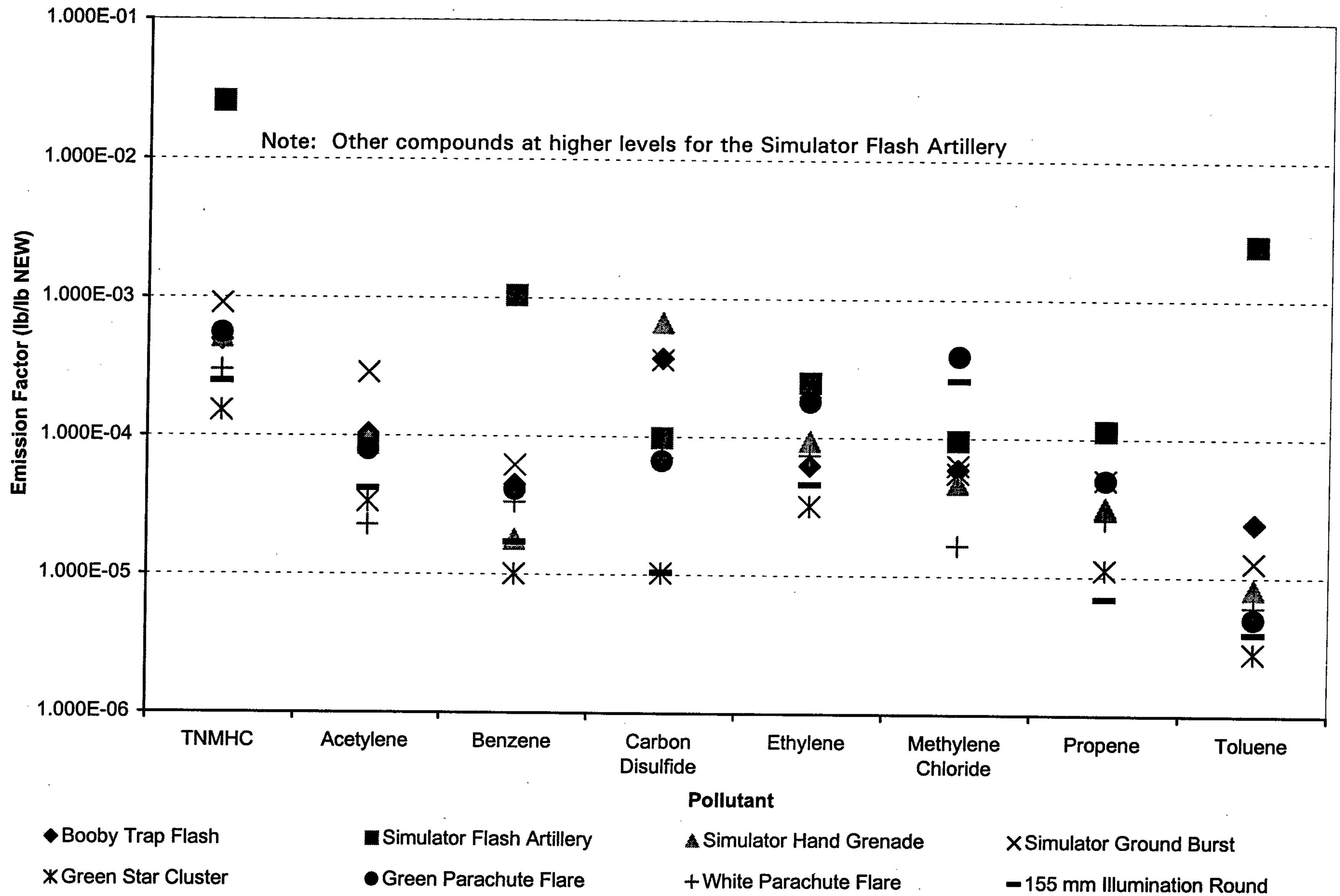

Figure 6. Representative VOC Emission Factors for AEC Training Ordnance

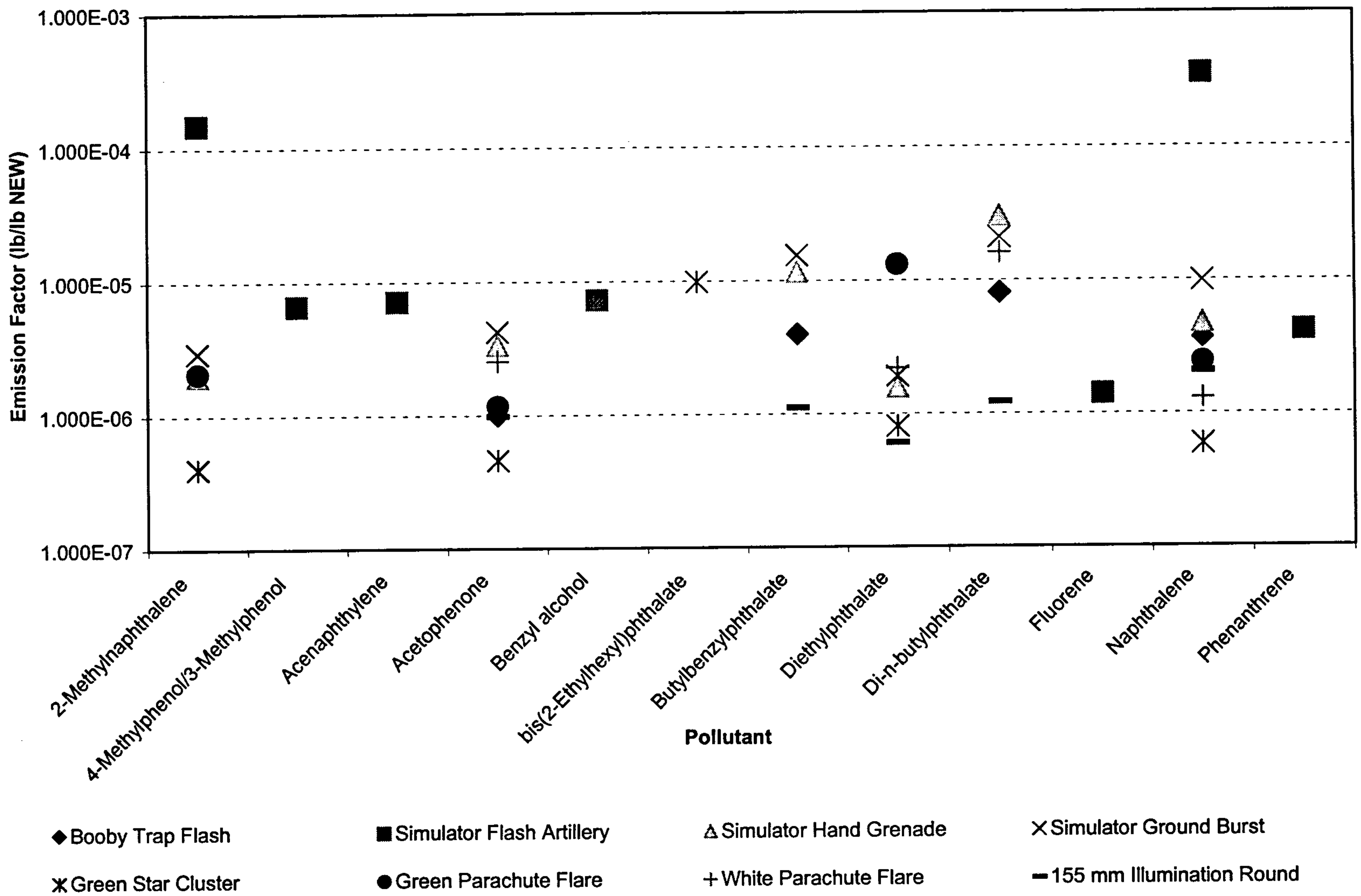

Figure 7. SVOC Emission Factors for AEC Training Ordnance

drawings, specifications, standards, and other information. The MIDAS data for these items are included in Appendix I-D. Table 12 shows the theoretical emission factors for all those metals that were listed in the MIDAS database. Figure 5 provides a comparison of the measured and theoretical emission factors for those metals present based on the MIDAS data. The ratio of measured data to theoretical data was generally lower than 1.0. This is reasonable considering that the metals are associated with particles that do not remain airborne (they settle to the ground). Some ratios were greater than 1.0. The cause for the higher then expected concentration of metals and the presence of metals not expected is unknown. In the higher concentration cases, it is suspected that the metals were present in the items at higher levels than listed in the MIDAS database (e.g., antimony and magnesium in the Booby Trap Flash and phosphorous in the Simulator Hand Grenade). For those metals found but not listed in the MIDAS database, it is suspected that the MIDAS information may not provide all the data on the content of each item. The relatively low levels of aluminum in the Green Parachute Flare and the Green Star Cluster may be from the BangBox environment. The BangBox floor was cleaned prior to and following each test in order to reduce and prevent contamination. Examination of the data does not indicate any significant compound carry-over from item to item.

Figure 6 shows a comparison of eight representative VOCs. The tables in Appendix II-E summarize the analytical data for all eight tests. These eight compounds represent the highest emission factors for each munition item except for the Simulator Flash Artillery M110. The tables in Appendix II-E for the Simulator Flash Artillery M110 show that a large number of VOCs were found at higher levels. The levels of VOCs were consistently higher than the SVOCs.

Twelve SVOCs were found in one or more of the test runs. The tables in Appendix II-F summarize the analytical data for all eight test series. Four of the twelve SVOCs were also found in the reagent blank or the field blank [i.e., acetophenone, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, and di-n-butylphthalate]. These four measurements are reported in the test samples at substantial or equivalent quantities. These compounds are included in Tables 4 to 11, but it is questionable whether they represent compounds from the munition items. Figure 7 shows that for the majority of the measured SVOCs the resulting emission factors were relatively low ($<1 \times 10^{-5}$) in comparison to other compounds. Figure 7 shows that similar values were measured for all items except the Simulator Flash Artillery M110.

Appendix I-A and II-A show that measurements were also made for HCl, Cl_2, and dioxin/furans. HCl levels were too low to be reliably measured by either the impinger train or the continuous analyzer. Emission factors for seven of the eight munitions were developed for Cl_2. However, most sample concentrations were at similar values in the field blanks and reagent blanks. Dioxin/furan isomers were reported at very low (picogram or 1×10^{-12} gram) levels in some of the samples. These were expressed as 2,3,7,8-TCDD toxic equivalent (TEQ) using a toxicity equivalency factor for each isomer. This procedure is shown in the sample calculations in Appendix 1-C. Note that similar values were also reported in the backgrounds, field blanks, and reagent blanks. The TEQ (total of reported value or detection limit for each isomer) in the blanks ranged from 6.0-17.1 pg (picograms). The TEQ for backgrounds ranged from 7.3-30.3 pg. The TEQ in the samples ranged from 6.7-40.8 pg. The highest sample value, 40.8, was offset by a 7.9 in the duplicate sample. This data indicates that deploying these items does not produce measurable dioxins/furans.

Table 12. AEC Training Ordnance Theoretical Emission Factors for Applicable Metals[a]

AEC Munition	Aluminum EF (lb/lb NEW)	Antimony EF (lb/lb NEW)	Barium EF (lb/lb NEW)	Cadmium EF (lb/lb NEW)	Chromium EF (lb/lb NEW)	Cobalt EF (lb/lb NEW)	Lead EF (lb/lb NEW)	Magnesium EF (lb/lb NEW)	Manganese EF (lb/lb NEW)	Phosphorus EF (lb/lb NEW)
Booby Trap Flash M117	NA	1.05E-02	NA	NA	NA	NA	NA	4.26E-03	NA	3.27E-03
Simulator Flash Artillery M110	NA	NA	9.58E-02	NA	NA	NA	NA	4.44E-01	NA	NA
Simulator Hand Grenade	6.60E-02	NA	NA	NA	NA	NA	NA	8.63E-02	NA	1.34E-04
Simulator Ground Burst	1.75E-01	NA	NA	NA	NA	NA	NA	NA	NA	1.22E-04
Green Star Cluster	4.62E-06	8.28E-06	4.81E-03	NA	9.88E-05	5.62E-06	1.42E-05	6.18E-03	NA	NA
Green Parachute Flare	2.45E-05	4.32E-05	1.73E-01	1.01E-02	5.15E-04	NA	7.39E-05	1.50E-01	NA	NA
White Parachute Flare	2.76E-05	4.94E-05	1.71E-03	NA	5.89E-04	1.34E-04	8.45E-05	4.42E-01	NA	NA
155mm Illumination Round	NA	NA	5.38E-03	NA	4.54E-05	NA	1.62E-04	4.66E-01	2.00E-04	NA

[a]All theoretical emission factors were calculated based on database munition item constituents.

AEC = Army Environmental Center
EF = Emission Factor
NEW = Net Explosive Weight

3.3 Data Quality

Assessment of data quality for the AEC training ordnance BangBox tests is based on analysis results for quality control (QC) samples. QC samples applicable to field activities or the sample matrix included field reagents and blank trains, spiked sampling media, and surrogate spikes. QC data pertinent to laboratory activities include calibration checks, laboratory method blanks, and laboratory control samples (LCS)/laboratory control sample duplicates (LCSD). The QC data were reviewed to assess the overall data quality and potential impact on sample measurement results. Also reviewed were sample preservation and holding time considerations. Table 13 summarizes the data quality objectives for the testing.

TSP/PM$_{10}$. Particulate loading on filters was determined gravimetrically. Filters were desiccated and tared to the nearest 0.1 mg. After sampling, filters were desiccated and weighed to a constant weight to determine final weight gain. The analytical balance was calibrated daily during use. Blank filter samples all showed negligible weight gain.

Metals. Concentrations of metals in TSP samples were determined using inductively coupled plasma (ICP) emission spectroscopy and, for mercury, CVAA spectroscopy. All samples were analyzed within specified holding times. QC data indicate valid, accurate results with possible low bias results for aluminum, magnesium, and antimony. Analytical performance was consistently good. Some data analysis was not possible for certain filter/TSP samples due to insufficient material. For the analysis, the filters fell into three sample preparation categories: (1) blank/background filters with little to no measurable TSP, (2) heavily loaded filters with an excess of 1 gram of TSP, and (3) lightly loaded filters with <0.75 grams of TSP. Filters in the first category (blank/background filters) were prepared by taking three representative strips of the filter (about ¼ of the whole filter) and digesting them in a closed microwave-digestion vessel with hydrogen fluoride (HF), HNO_3, and HCl. The digestate was split for metals by ICP and for mercury by CVAA (SW-7470A). These data are included in the analytical reports (Volume II). The second group of filters contained a sufficient amount of loose TSP to allow an independent digestion and analysis of the TSP alone. The loose dust recovered from the filters was prepared by a mixed-acid microwave digestion followed by a nitric acid digestion for metals by ICP and for direct digestion and analysis for mercury in solids by CVAA using SW-7471A. The third category of filter samples did not possess a sufficient quantity of TSP to allow separate digestions for ICP metals and mercury. After examination of the alternatives, it was decided to prepare the ICP metals sample in the same manner as the category 2 samples to maximize the number of analytes reported for the TSP. The sample preparation involved two steps to eliminate the high acid-salt content normally generated by the mixed-acid microwave digestion. The nitric acid digestion involves near evaporation of the microwave digestate in an open container to reduce the amount of excess HF and HCl. This also results in the loss of mercury, and so the analysis of this digestate was considered inappropriate and foregone for the sake of producing comparable ICP data for mercury.

Samples of particulate matter collected on the TSP filters were analyzed for metals using Method SW-6010A and mercury using Method SW-7471A by Radian Laboratories. The QC data indicate effective analyses and reliable measurement data. All samples were analyzed within specified holding times. Samples were analyzed undiluted and at a 1:10 dilution because barium exceeded the calibration range for several samples. Dilutions are also analyzed to mitigate matrix effects and ensure reliable measurement results.

Table 13. Measurement Quality Objectives

Test Parameter	Accuracy Objective	Precision Objective
TSP	Not assessable	RSD <25% for multiple runs on a single event
PM_{10}	Not assessable	Not assessable
Metals	75-125% recovery of post-digestion MS from filter	<20% RPD for recovery of post-digestion MS/MSD from filter
VOC	70-130% recovery of laboratory media spike (laboratory calibration check material, transferred into a canister, and analyzed with the field samples)	<30% RPD for top ten peaks on laboratory duplicate analyses
Tracer Compound	80-120% recovery of laboratory media spike	±10% RPD for laboratory duplicate analyses
SVOC	Surrogate spike recoveries within laboratory control limits	<35% RSD for pooled surrogate spike recoveries for all samples from a single event
HCl/Cl_2	85 – 115% recovery for MS	< 25% RPD for MS/MSD pair
Dioxins/Furans	70-130% recovery of pre-sampling surrogate spike compounds	<50% RSD for pooled surrogate spike recoveries for all samples from a single event
CO	±5% of span for zero and upscale bias checks	±3% of span for zero and upscale drift checks
CO_2	±5% of span for zero and upscale bias checks	±3% of span for zero and upscale drift checks
NO_X	±5% of span for zero and upscale bias checks	±3% of span for zero and upscale drift checks
SO_2	±5% of span for zero and upscale bias checks	±3% of span for zero and upscale drift checks
HCl	±5% of span for zero and upscale bias checks	±3% of span for zero and upscale drift checks

CO = Carbon Monoxide
CO_2 = Carbon Dioxide
Cl_2 = Chlorine
HCl = Hydrogen Chloride
MS = Matrix Spike
MSD = Matrix Spike Duplicate
NO_X = Nitrogen Oxides
PM_{10} = Particulate Matter less than 10 microns
RPD = Relative Percent Difference
RSD = Relative Standard Deviation
SO_2 = Sulfur Dioxide
SVOC = Semivolatile Organic Compound
TSP = Total Suspended Particulates
VOC = Volatile Organic Compound

Initial and continuing calibration checks were all within acceptance criteria, except for boron on one continuing calibration verification sample. Boron is not a target analyte and this discrepancy does not affect data quality. Laboratory method blank results were all below the concentrations found in the samples.

LCSD duplicate results were within the 75-125% recovery objective and 20% relative percent difference (RPD) precision objective for the 18 ICP (Method SW-6010A) analytes and mercury (Method SW-7471A) with the exception of aluminum, antimony, and magnesium. These analytes were recovered outside the QC criteria in two of the four analytical batches. On the fourth analytical batch, aluminum and magnesium were reanalyzed with all analytes recovered within the QC limits.

Recoveries of metals spike into field samples [i.e., matrix spikes (MSs)] were good. All MS/matrix spike duplicate (MSD) analysis results for sample DPG-541 were within the 75-125% recovery objective except for aluminum (60 and 44%) and magnesium (70 and 58%). Results for analysis of post-digestion spikes (analytical spikes) for this sample yielded compliant recoveries for all analytes except antimony. Analytical spikes were needed because of the high levels of metals (e.g., aluminum and magnesium) in some samples. The initial spiking solutions did not contain adequate aluminum to assess recoveries. MS recoveries for aluminum, barium, beryllium, chromium, lead, and magnesium in sample DPG-802 were outside the QC criteria in both the undiluted and 1:10 dilution. Results of analytical spikes for DPG-802 were within QC limits with the exception of magnesium (150%) in the undiluted analysis and barium (70%) in the 1:10 dilution. MS recoveries for mercury in sample DPG-341 were found at 128 and 132%, which is only slightly outside the QC criteria of 70-130% for mercury. Results of analytical spikes for this sample and DPG-251 were all within the 85-115% recovery objective.

VOC and Tracer Compounds. Air samples collected in stainless steel canisters were analyzed for VOCs using GC/multiple detectors for Method TO-14 and Method TO-12. Tracer compounds were measured using an electron capture detector. Appreciable levels of organics and SF_6 tracer compounds were detected by the analytical methods utilized. Background analyses showed the presence of low levels of VOCs. The VOC analyses indicated acceptable analytical method performance and accurate measurement results.

SVOCs. Concentrations of SVOCs in air samples were determined using GC/MS. All samples were analyzed within prescribed holding times. The QC data indicated reliable, effective analyses, as discussed below.

SVOCs in air samples captured on XAD resin were analyzed using GC/MS Method SW-8270B by Radian Laboratories. Initial and continuing calibration checks were within acceptance limits. There was no evidence of laboratory contamination, based on results for analysis of laboratory method blanks.

LCS results indicate accurate and reliable method performance for the LCS, but all analytes were outside the limits (0.1–124%) in the LCSD except for hexachlorocyclopentadiene at 6.4%. All recoveries were low due to a problem in the sample preparation because of a possible cracked extractor. These analyses could not be reextracted because there was no remaining XAD from that batch. However, all previous LCS results for

all previous analyses have been within the specified recovery limits and all other QC samples indicate accurate data results.

Results for analysis of spiked collection media (XAD resin) samples indicated effective recovery, with recoveries and precision within laboratory specifications for all the spike compounds in the initial spiked sample. In the duplicate analysis, 7 of the 11 analytes were just outside the QC limits (18 to 21%) as well as the RPDs associated with these analytes. These discrepancies were attributed to matrix effects, and no corrective action was taken.

Surrogate spike recoveries were within recovery limits in all the samples, except for the following. Recoveries of phenol-d5 (128 and 128%) and 2-fluorobiphenyl (117 and 118%) in the collection medium spike and spike duplicate were above the QC criteria of 50–122% and 54–115%, respectively. For the second analytical batch, sample DPG-772 had recovery of phenol-d5 at 125%. Surrogate recoveries for the LCS were all below the QC limits except 2,4,6-tribromophenol (29%), while all surrogate recoveries for the LCSD were within the limits. Surrogates in the collection medium spike were all within the QC criteria, while the duplicate had low recoveries for 2-fluorobiphenyl (51%), 2-fluorophenol (6.5%), nitrobenzene (19%), and phenol-d5 (11%). Recoveries of the other acid and base-neutral surrogates were within the QC limits, indicating acceptable extraction efficiency and measurement accuracy.

HCl/Cl_2. Gas train samples collected in the sodium hydroxide and sulfuric acid impingers of the sample trains were analyzed by ion chromatography by Radian Laboratories. All analyses were conducted within the specified holding time. QC data indicate good analytical system control and reliable measurement results. Field blanks and background sample concentrations were similar to those found in the field samples.

Initial and continuing calibration checks were within the limits with the exception of one CCV (119%). This calibration check was reanalyzed immediately and the specification was met at 107%. All laboratory control spike samples were within QC limits. All laboratory method blank and reagent blank results indicated no systematic contamination. All MS and MSD samples demonstrated effective analyses in the sample matrices.

Dioxins/Furans. Seven PUF samples were received on March 31 and nineteen samples were received on April 2 by Triangle Laboratories. All samples were extracted and analyzed according to the procedures described in EPA Method 8290 Rev. 0 (September 1994). All samples were analyzed within the holding times. Some values were reported at every low levels in the blanks and samples. These data were below the established calibration range for the instrument. However, QC data indicate acceptable measurement results.

All initial and continuing calibration results were within the acceptance criteria. There were no contamination problems associated with the laboratory method blank.

The PUF cartridge for sample DPG-445 was broken when received by the laboratory. The cartridge was carefully taped to prevent loss of any XAD resin. Most (>95%) of the XAD was recovered by the laboratory. The PUF cartridge could not be rinsed with toluene due to the adhesive from the tape.

Recoveries for the LCS/LCSD analyses were within the 70–130% recovery and 20% RPD objective except for the following. The percent recovery for 1,2,3,4,6,7,8-HpCDF was above the QC limits and the percent recovery for OCDF was below the QC limits. Also, the RPD for 1,2,3,4,6,7,8-HpCDF was above the QC criteria. Laboratory guidelines allow up to two analytes to have recoveries as high as 145%, so long as the RPD is within the QC criteria. All the associated analytes detected in the method blank and field samples are below the target detection limit. The results are not significantly affected.

CEM. CO, CO_2, HCl, NO_x, and SO_2 were sampled and analyzed using a real-time CEM system. Examination of the data quality objectives summarized in Table 16 show that the desired goals for accuracy and precision were 5% of span for bias checks and 3% of span for drift checks. These values were met for all tests as demonstrated by calibration checks before and after each run. The QC data indicate good analyzer system control and reliable measurement results.

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4. CONCLUSIONS

This report presents the results from the first phase of testing for the development of airborne emission factors for compounds produced by deployment of conventional munitions training items. Similar types of compounds were produced by all items tested. However, the compound-by-compound emission factors varied between items. There was considerable variation for some compounds even for similar items, (e.g., Green and White Parachute Flares).

Replicate runs were performed for three items with the highest priority for testing. For two items the compound variation between runs was similar to that associated with measurement variability. For the other item there was more variability between runs than would be expected from just variation in measurement accuracy.

TSP/PM_{10}. TSP and PM_{10} were the primary compounds emitted for all eight munitions items. The particulate matter was small – for most items essentially all the particles were PM_{10}. The measured PM_{10} emission factors were larger than the TSP emission factors for some items. This reflects the fact that the PM_{10} sampling duration was fairly short and occurred early in the test cycle. The TSP represents an average concentration over a longer period as particles settled. In these cases TSP is probably the better emission factor for both TSP and PM_{10} that is likely to migrate off-site. Particle sizing measurements will be incorporated into Phase III tests for these items.

Metals. Particulate samples showed significant quantities of some metals. The higher levels of aluminum, antimony, barium, magnesium, and phosphorus in some items correspond to enriched levels of those compounds in the items. The measured metals emission factors were compared to the theoretical levels from the MIDAS database. Reactive and more "volatile" metals (i.e., aluminum, magnesium, and phosphorus) were measured near their theoretical levels. Most other metals were measured at somewhat lower levels (<10% of theoretical).

VOCs and SVOCs. Most of the organic compounds produced by deployment of the items were VOCs. The concentrations of VOCs were 1 to 2 orders of magnitude higher than SVOCs.

HCl/Cl_2. The low levels of chlorine in the items produced concentrations of HCl and Cl_2 that were difficult to accurately quantify.

Dioxin/furan. Dioxin/furan values reported by the laboratory in the samples were similar to those reported in field blanks and reagent blanks. The data does not indicate that dioxins/furans are produced by deploying the items.

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APPENDIX I-A. ANALYTE LISTS

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Table A-1. Metals Analyte List (EPA Method 29)

Metals			
Aluminum	Cadmium	Magnesium	Selenium
Antimony	Chromium	Manganese	Silver
Arsenic	Cobalt	Mercury	Thallium
Barium	Copper	Nickel	Zinc
Beryllium	Lead	Phosphorus	

Table A-2. VOC Analyte List (EPA Compendium Method TO-14)

Analytes			
1,1,2,2-Tetrachloroethane	2-Methyl-1-butene	cis/trans-4-Methyl-2-pentene	Methylcyclopentane
1,1,2-Trichloro-1,2,2-trifluoroethane	2-Methyl-1-pentene	cis-1,3-Dichloro-1-propene	Methylene chloride
1,1,2-Trichloroethane	2-Methyl-2-butene	cis-2-Butene	Methylnitrite
1,1-Dichloroethane	2-Methyl-2-pentene	cis-2-Hexene	m-Ethyltoluene
1,2,4-Trichlorobenzene	2-Methylfuran	cis-2-Pentene	Methyl tert-butyl ether
1,2,4-Trimethylbenzene & sec-Butylbenzene	2-Methylheptane	Cyanogen	Methyl-vinyl Ketone
1,2-Dibromoethane	2-Methylhexane	Cyclohexane	Naphthalene
1,2-Dichloroethane	2-Methylnaphthalene	Cyclohexanone	n-Butane
1,2-Dichloroethene	2-Methylpentane	Cyclopentane	n-Decane
1,2-Dichloropropane	2-Methylpropanal	Cyclopentanone	n-Heptane
1,3,5-Trimethylbenzene	2-Methylpropanenitrile	Cyclopentene	n-Hexane
1,3-Butadiene	2-Nitrophenol	Decanal	Nitromethane
1,4-Dioxane	2-Pentanone	delta 3-Carene	n-Nonane
1-Butanol	2-Propanol	Dichlorodifluoromethane	n-Octane
1-Butene	3-Ethylhexane	Dichlorotetrafluoroethane	Nonanal
1-Hexene	3-Methyl-1-butene	Dimethyl disulfide	n-Pentane
1-Hydroxy-2-propanone	3-Methylhexane	d-Limonene	n-Propylbenzene
1-Methylnaphthalene	3-Methylpentane	Ethane	Octanal
1-Pentene	4-Methyl-1-pentene	Ethyl tert-butylether	o-Dichlorobenzene
1-Propanol	6-Methyl-5-hepten-2-one	Ethylbenzene	o-Ethyltoluene
2,2,4-Trimethylhexane	Acetic Acid	Ethylchloride	o-Xylene
2,2,4-Trimethylpentane	Acetone	Ethylcyclohexane	p-Dichlorobenzene
2,2-Dimethylbutane	Acetonitrile	Ethylene	Pentanal
2,2-Dimethylheptane	Acetophonone	Furan	Pentanenitrile
2,2-Dimethylpropane	Acetylene	Heptanal	Perchloroethylene
2,3,4-Trimethylpentane	Acrolein	Hexachlorobutadiene	p-Ethyltoluene
2,3-Butanedione	Acrylonitrile	Hexanal	Phenylacetylene
2,3-Dihydro-1-methyl-1H-indene	Allylchloride	Hexanenitrile	Propane
2,3-Dihydro-4-methyl-1H-indene	alpha-Pinene	i-Butane	Propanenitrile
2,3-Dimethylbutane	Benzaldehyde	i-Butene	Propene
2,3-Dimethylhexane	Benzene	Indane	Styrene
2,3-Dimethylpentane	Benzofuran	i-Pentane	Tetrahydrofuran
2,4,4-Trimethyl-1-pentene	Benzonitrile	i-Propylbenzene	Thiophene
2,4,4-Trimethyl-2-pentene	Benzylchloride	Isoprene	Toluene
2,4-Dimethylhexane	beta-Pinene	m&p-Xylene	trans-1,3-Dichloro-1-propene
2,4-Dimethylpentane	Butanol	m-Dichlorobenzene	trans-2-Butenal
2,5-Dimethylhexane	Carbon disufide	Methacrolein	trans-2-Butene
2-Butanone	Carbon tetrachloride	Methyl Methacrylate	trans-2-Hexene
2-Butoxyethonol	Carbonyl sulfide	Methylbromide	trans-2-Pentene
2-Ethyl-1-hexanol	Chlorobenzene	Methylchloride	Trichloroethylene
2-Furaldehyde	Chloroethene	Methylchloroform	Trichloromono fluoromethane
2-Methyl-1,3-dioxolane	Chloroform	Methylcyclohexane	Vinylidene chloride

Table A-3. SVOC Analyte List (EPA SW-846 Method 8270)

Analytes			
1,2,4-Trichlorobenzene	3-Nitroaniline	bis(2-Ethylhexyl)phthalate	Naphthalene
1,2-Dichlorobenzene	4,6-Dinitro-2-methylphenol	Butylbenzylphthalate	Nitrobenzene
1,3-Dichlorobenzene	4-Aminobiphenyl	Carbazole	N-Nitrosodiethylamine
1,3-Dinitrobenzene	4-Bromophenylphenyl ether	Chlorobenzilate	N-Nitrosodimethylamine
1,4-Dichlorobenzene	4-Chloro-3-methylphenol	Chrysene	N-Nitroso-di-n-butylamine
1,4-Naphthoquinone	4-Chlorophenylphenyl ether	Diallate	N-Nitroso-di-n-propylamine
1-Naphthylamine	4-Methylphenol/3-Methylphenol	Dibenz(a,h)anthracene	N-Nitrosomethylethylamine
2,3,4,6-Tetrachlorophenol	4-Nitroaniline	Dibenzofuran	N-Nitrosomorpholine
2,4,5-Trichlorophenol	4-Nitrophenol	Diethylphthalate	N-Nitrosopiperidine
2,4,6-Trichlorophenol	4-Nitroquinoline-1-oxide	Dimethylphenethylamine	N-Nitrosopyrrolidine
2,4-Dichlorophenol	5-Nitro-o-toluidine	Dimethylphthalate	o-Toluidine
2,4-Dimethylphenol	7,12-Dimethylbenz(a)anthracene	Di-n-butylphthalate	p-Chloroaniline
2,4-Dinitrophenol	Acenaphthene	Di-n-octylphthalate	p-Dimethylaminoazobenzene
2,4-Dinitrotoluene	Acenaphthylene	Diphenylamine/N-Nitrosodiphenylamine	Pentachlorobenzene
2,6-Dichlorophenol	Acetophenone	Ethyl methanesulfonate	Pentachloroethane
2,6-Dinitrotoluene	Aniline	Fluoranthene	Pentachloronitrobenzene
2-Acetylaminofluorene	Anthracene	Fluorene	Pentachlorophenol
2-Chloronaphthalene	Benz(a)anthracene	Hexachlorobenzene	Phenacetin
2-Chlorophenol	Benz(a)pyrene	Hexachlorobutadiene	Phenanthrene
2-Methylnaphthalene	Benzidine	Hexachlorocyclopentadiene	Phenol
2-Methylphenol	Benzo(b)fluoranthene	Hexachloroethane	Pronamide
2-Naphthylamine	Benzo(g,h,i)perylene	Hexachloropropene	Pyrene
2-Nitroaniline	Benzo(k)fluoranthene	Indeno(1,2,3-cd)pyrene	Pyridine
2-Nitrophenol	Benzoic acid	Isophorone	Safrole
2-Picoline	Benzyl alcohol	Isosafrole	sym-Trinitrobenzene
3,3'-Dichlorobenzidine	bis(2-Chloroethoxy)methane	Kepone	
3,3'-Dimethylbenzidine	bis(2-Chloroethyl)ether	Methapyrilene	
3-Methylcholanthrene	bis(2-Chloroisopropyl)ether	Methyl methanesulfonate	

Table A-4. Dioxin/Furan Analyte List (EPA SW-846 Method 8290)

Dioxins			
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	
Furans			
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		

APPENDIX I-B. EMISSION FACTOR SUMMARY DATA

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Table B-1. AEC Training Ordnance Emission Factors

Compound	Simulator Booby Trap Flash M117				Simulator Flash Artillery M110				Simulator Hand Grenade			
	Average NEW, lb = 0.22				Average NEW, lb = 0.19				Average NEW, lb = 0.32			
	Average Number of Items = 29				Average Number of Items = 1				Average Number of Items = 4			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Particulate												
TSP	3.056E+01	8.255E-02	3.730E-01	2.872E-03	1.939E+01	-2.672E-03	2.711E-01	5.082E-02	1.424E+02	-6.288E-02	1.064E+00	8.619E-02
PM_{10}	3.639E+01	1.144E-01	3.971E-01	3.058E-03	3.188E+01	1.793E-02	4.007E-01	7.513E-02	1.678E+02	-8.049E-01	1.220E+00	9.883E-02
HCl/Cl_2												
HCl (a)	ND	ND	ND	ND	5.294E-02	ND	7.463E-04	1.399E-04	ND	ND	ND	ND
Cl_2 (a)	4.167E-02	2.508E-03	4.792E-04	3.690E-06	2.276E-02	3.231E-03	2.733E-04	5.124E-05	1.108E-02	3.877E-03	5.560E-05	4.504E-06
Dioxin/Furan												
Dioxin TEQ (b)	4.983E-10	1.246E-10	4.574E-12	3.522E-14	3.417E-10	1.371E-10	6.954E-12	1.304E-12	1.459E-10	ND	1.114E-12	9.021E-14
CEM System												
Carbon Monoxide (CO)	7.180E-01	1.403E-01	7.070E-03	5.444E-05	2.524E+00	1.385E-01	3.344E-02	6.270E-03	3.871E-01	2.252E-02	3.166E-03	2.565E-04
Nitrogen Oxide (NOx)	4.954E-01	1.860E-02	5.834E-03	4.492E-05	7.375E-01	4.064E-02	9.685E-03	1.816E-03	7.996E+00	3.925E-02	6.705E-02	5.431E-03
HCl (a)	-4.968E-02	-3.951E-02	ND	ND	-1.295E-01	-4.682E-02	1.327E-04	2.488E-05	3.078E-02	8.719E-01	ND	ND
Carbon Dioxide (CO_2)	7.081E+02	7.099E+02	ND	ND	7.726E+02	6.822E+02	1.275E+00	2.391E-01	6.927E+02	6.829E+02	4.921E-02	3.986E-03
Sulfur Dioxide (SO_2)	4.233E+00	1.598E-03	5.178E-02	3.987E-04	5.554E-02	1.833E-04	7.763E-04	1.455E-04	6.450E-01	-9.235E-04	5.568E-03	4.510E-04
Particulate-phase Metals												
Aluminum	8.785E-02	NM (c)	1.075E-03	8.279E-06	1.076E-01	NM (c)	1.506E-03	2.824E-04	1.408E+01	NM (c)	1.050E-01	8.507E-03
Antimony	8.363E+00	NM (c)	1.023E-01	7.881E-04	1.515E-02	NM (c)	2.134E-04	4.002E-05	2.507E-02	NM (c)	1.862E-04	1.509E-05
Arsenic	1.668E-02	NM (c)	2.041E-04	1.572E-06	ND	NM (c)	ND	ND	3.443E-04	NM (c)	2.574E-06	2.085E-07
Barium	1.406E-03	NM (c)	1.721E-05	1.325E-07	1.168E+00	NM (c)	1.630E-02	3.057E-03	4.949E-02	NM (c)	3.682E-04	2.983E-05
Beryllium	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND	4.732E-05	NM (c)	3.571E-07	2.893E-08
Cadmium	6.546E-05	NM (c)	8.011E-07	6.169E-09	1.056E-04	NM (c)	1.463E-06	2.744E-07	2.907E-04	NM (c)	2.166E-06	1.754E-07
Chromium	1.415E-03	NM (c)	1.731E-05	1.333E-07	2.906E-03	NM (c)	4.052E-05	7.598E-06	7.877E-04	NM (c)	5.864E-06	4.750E-07
Cobalt	8.600E-05	NM (c)	1.052E-06	8.103E-09	3.293E-04	NM (c)	4.594E-06	8.613E-07	4.251E-04	NM (c)	3.173E-06	2.570E-07
Copper	1.458E-02	NM (c)	1.785E-04	1.374E-06	2.591E-02	NM (c)	3.620E-04	6.788E-05	2.327E-02	NM (c)	1.727E-04	1.398E-05
Lead	2.167E-02	NM (c)	2.652E-04	2.042E-06	3.693E-03	NM (c)	5.158E-05	9.672E-06	1.782E-03	NM (c)	1.332E-05	1.079E-06
Magnesium	1.819E+00	NM (c)	2.226E-02	1.714E-04	5.400E+00	NM (c)	7.597E-02	1.424E-02	1.673E+01	NM (c)	1.248E-01	1.011E-02
Manganese	3.955E-03	NM (c)	4.839E-05	3.726E-07	4.337E-03	NM (c)	6.042E-05	1.133E-05	1.585E-02	NM (c)	1.183E-04	9.581E-06
Nickel	2.455E-04	NM (c)	3.004E-06	2.313E-08	1.768E-04	NM (c)	2.455E-06	4.603E-07	1.550E-03	NM (c)	1.155E-05	9.356E-07
Phosphorus	2.264E-01	NM (c)	2.770E-03	2.133E-05	2.107E-03	NM (c)	2.926E-05	5.486E-06	1.964E-02	NM (c)	1.459E-04	1.182E-05
Selenium	1.798E-04	NM (c)	2.200E-06	1.694E-08	ND	NM (c)	ND	ND	3.371E-04	NM (c)	2.469E-06	2.000E-07
Silver	3.543E-04	NM (c)	4.336E-06	3.339E-08	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND
Thallium	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND
Zinc	9.399E-03	NM (c)	1.150E-04	8.856E-07	5.827E-03	NM (c)	8.108E-05	1.520E-05	1.600E-02	NM (c)	1.189E-04	9.628E-06
Mercury	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND	2.198E-06	NM (c)	1.638E-08	1.326E-09

NM = Not Measureable

a

HCl/Cl_2 levels were too low to be reliably measured.

b

Presence questionable - reported at similar levels in samples and blanks.

c

Insufficient material to analyze.

Table B-1. (Continued)

Compound	Simulator Ground Burst Average NEW, lb = 0.35 Average Number of Items = 2.5				Green Star Cluster Signal Flare Average NEW, lb = 1.67 Average Number of Items = 1				Green Parachute Signal Flare Average NEW, lb = 0.32 Average Number of Items = 1			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Particulate												
TSP	9.907E+01	-6.288E-02	7.600E-01	1.064E-01	3.072E+01	3.893E-02	4.499E-02	7.508E-02	5.503E+01	3.893E-02	4.241E-01	1.340E-01
PM_{10}	1.181E+02	-8.049E-01	8.358E-01	1.170E-01	2.762E+01	9.455E-02	3.801E-02	6.345E-02	4.859E+01	9.455E-02	3.581E-01	1.132E-01
HCl/Cl_2												
HCl (a)	7.324E-02	ND	6.403E-04	8.964E-05	7.165E-02	ND	1.051E-04	1.753E-04	ND	ND	ND	ND
Cl_2 (a)	6.344E-02	3.877E-03	5.204E-04	7.286E-05	1.748E-02	1.380E-02	5.392E-06	8.998E-06	1.574E-02	1.380E-02	1.528E-05	4.830E-06
Dioxin/Furan												
Dioxin TEQ (b)	1.487E-09	ND	1.300E-11	1.821E-12	2.664E-10	1.512E-10	1.690E-13	2.820E-13	1.380E-09	1.512E-10	9.683E-12	3.060E-12
CEM System												
Carbon Monoxide (CO)	2.080E+00	2.687E-01	2.898E-02	4.057E-03	4.242E+00	2.661E-01	5.805E-03	9.689E-03	3.939E+00	5.106E-01	2.643E-02	8.350E-03
Nitrogen Oxide (NOx)	4.973E+00	3.974E-02	7.201E-02	1.008E-02	6.984E-01	4.099E-02	9.599E-04	1.602E-03	9.963E-01	1.313E-01	6.668E-03	2.107E-03
HCl (a)	-1.838E+00	-2.129E-01	ND	ND	6.057E-02	9.941E-02	ND	ND	-3.659E-01	-3.404E-01	ND	ND
Carbon Dioxide (CO_2)	6.803E+02	6.726E+02	9.551E-02	1.337E-02	7.272E+02	6.695E+02	8.422E-02	1.406E-01	7.370E+02	7.034E+02	2.589E-01	8.182E-02
Sulfur Dioxide (SO_2)	1.184E-01	-2.744E-02	1.896E-03	2.654E-04	2.268E-03	2.445E-03	ND	ND	7.964E-04	-2.560E-02	2.035E-04	6.430E-05
Particulate-phase Metals												
Aluminum	1.749E+01	NM (c)	1.264E-01	1.770E-02	1.011E-02	NM (c)	1.482E-05	2.473E-05	3.827E-02	NM (c)	2.952E-04	9.328E-05
Antimony	2.558E-02	NM (c)	1.842E-04	2.579E-05	5.252E-04	NM (c)	7.700E-07	1.285E-06	4.842E-04	NM (c)	3.735E-06	1.180E-06
Arsenic	2.310E-04	NM (c)	1.953E-06	2.734E-07	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND
Barium	5.871E-02	NM (c)	4.194E-04	5.871E-05	5.109E-01	NM (c)	7.491E-04	1.250E-03	3.535E+00	NM (c)	2.727E-02	8.617E-03
Beryllium	4.264E-05	NM (c)	3.134E-07	4.387E-08	6.956E-06	NM (c)	1.020E-08	1.702E-08	6.674E-06	NM (c)	5.148E-08	1.627E-08
Cadmium	3.575E-04	NM (c)	2.577E-06	3.608E-07	3.421E-05	NM (c)	5.016E-08	8.372E-08	4.751E-04	NM (c)	3.664E-06	1.158E-06
Chromium	1.107E-03	NM (c)	7.952E-06	1.113E-06	2.643E-03	NM (c)	3.876E-06	6.469E-06	2.984E-03	NM (c)	2.302E-05	7.273E-06
Cobalt	5.423E-04	NM (c)	3.958E-06	5.541E-07	3.134E-04	NM (c)	4.595E-07	7.668E-07	1.492E-03	NM (c)	1.151E-05	3.637E-06
Copper	3.714E-02	NM (c)	2.677E-04	3.748E-05	3.929E-03	NM (c)	5.762E-06	9.616E-06	5.651E-03	NM (c)	4.359E-05	1.377E-05
Lead	3.726E-03	NM (c)	2.720E-05	3.808E-06	7.961E-04	NM (c)	1.167E-06	1.948E-06	1.887E-04	NM (c)	1.455E-06	4.599E-07
Magnesium	2.075E+01	NM (c)	1.503E-01	2.104E-02	3.118E+00	NM (c)	4.572E-03	7.631E-03	1.113E+01	NM (c)	8.587E-02	2.713E-02
Manganese	3.277E-02	NM (c)	2.428E-04	3.399E-05	6.595E-03	NM (c)	9.671E-06	1.614E-05	4.658E-03	NM (c)	3.593E-05	1.135E-05
Nickel	1.926E-03	NM (c)	1.408E-05	1.971E-06	1.989E-04	NM (c)	2.917E-07	4.868E-07	2.130E-04	NM (c)	1.643E-06	5.191E-07
Phosphorus	5.897E-02	NM (c)	4.344E-04	6.081E-05	2.547E-03	NM (c)	3.734E-06	6.232E-06	4.809E-03	NM (c)	3.710E-05	1.172E-05
Selenium	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND
Silver	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND
Thallium	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND
Zinc	2.803E-02	NM (c)	2.027E-04	2.837E-05	6.875E-03	NM (c)	1.008E-05	1.682E-05	1.518E-03	NM (c)	1.171E-05	3.699E-06
Mercury	1.817E-05	NM (c)	1.292E-07	1.809E-08	3.323E-06	NM (c)	4.873E-09	8.133E-09	5.603E-06	NM (c)	4.321E-08	1.366E-08

NM = Not Measureable

a

HCl/Cl_2 levels were too low to be reliably measured.

b

Presence questionable - reported at similar levels in samples and blanks.

c

Insuffic[illegible]terial to analyze.

Table B-1. (Continued)

Compound	White Parachute Signal Flare				155mm Illumination Round			
	Average NEW, lb = 0.28				Average NEW, lb = 6.12			
	Average Number of Items = 1				Average Number of Items = 1			
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Particulate								
TSP	8.628E+01	3.893E-02	7.354E-01	2.079E-01	1.163E+03	ND	4.244E-01	2.598E+00
PM_{10}	7.736E+01	9.455E-02	6.239E-01	1.764E-01	1.666E+03	ND	6.051E-01	3.705E+00
HCl/Cl_2								
HCl (a)	ND	ND	ND	ND	ND	ND	ND	ND
Cl_2 (a)	6.767E-02	1.380E-02	4.868E-04	1.376E-04	2.472E-02	3.022E-02	ND	ND
Dioxin/Furan								
Dioxin TEQ (b)	5.012E-10	1.512E-10	3.163E-12	8.942E-13	3.694E-09	1.484E-10	1.307E-12	8.001E-12
CEM System								
Carbon Monoxide (CO)	2.159E+00	2.190E-01	1.700E-02	4.807E-03	1.026E+01	2.826E-01	3.943E-03	2.414E-02
Nitrogen Oxide (NOx)	2.667E+00	1.668E-01	2.191E-02	6.195E-03	3.619E+01	1.737E-02	1.429E-02	8.750E-02
HCl (a)	4.143E-01	4.187E-01	ND	ND	4.549E-01	3.844E-01	2.784E-05	1.704E-04
Carbon Dioxide (CO_2)	6.630E+02	6.598E+02	2.725E-02	7.702E-03	1.358E+03	6.581E+02	2.767E-01	1.694E+00
Sulfur Dioxide (SO_2)	6.342E-02	1.801E-03	5.401E-04	1.527E-04	1.064E+00	7.430E-04	4.200E-04	2.571E-03
Particulate-phase Metals								
Aluminum	1.064E-02	NM (c)	9.076E-05	2.566E-05	1.960E-01	NM (c)	7.155E-05	4.381E-04
Antimony	7.467E-04	NM (c)	6.367E-06	1.800E-06	1.150E-02	NM (c)	4.197E-06	2.570E-05
Arsenic	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND
Barium	4.227E-02	NM (c)	3.605E-04	1.019E-04	2.121E-01	NM (c)	7.741E-05	4.740E-04
Beryllium	1.897E-05	NM (c)	1.617E-07	4.573E-08	1.384E-04	NM (c)	5.053E-08	3.094E-07
Cadmium	5.957E-05	NM (c)	5.080E-07	1.436E-07	4.037E-02	NM (c)	1.473E-05	9.022E-05
Chromium	3.570E-03	NM (c)	3.044E-05	8.607E-06	3.776E-03	NM (c)	1.379E-06	8.441E-06
Cobalt	1.231E-04	NM (c)	1.049E-06	2.967E-07	1.028E-03	NM (c)	3.751E-07	2.297E-06
Copper	3.630E-03	NM (c)	3.095E-05	8.750E-06	4.130E-02	NM (c)	1.507E-05	9.230E-05
Lead	2.607E-03	NM (c)	2.223E-05	6.285E-06	3.188E-02	NM (c)	1.164E-05	7.125E-05
Magnesium	1.144E+01	NM (c)	9.752E-02	2.757E-02	7.880E+01	NM (c)	2.877E-02	1.761E-01
Manganese	1.497E-02	NM (c)	1.276E-04	3.608E-05	2.958E-02	NM (c)	1.080E-05	6.611E-05
Nickel	4.400E-04	NM (c)	3.752E-06	1.061E-06	5.043E-03	NM (c)	1.841E-06	1.127E-05
Phosphorus	5.157E-03	NM (c)	4.398E-05	1.243E-05	3.234E-02	NM (c)	1.181E-05	7.229E-05
Selenium	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND
Silver	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND
Thallium	ND	NM (c)	ND	ND	ND	NM (c)	ND	ND
Zinc	2.344E-03	NM (c)	1.998E-05	5.649E-06	6.297E-01	NM (c)	2.298E-04	1.407E-03
Mercury	1.982E-05	NM (c)	1.690E-07	4.778E-08	9.773E-06	NM (c)	3.567E-09	2.184E-08

NM = Not Measureable

a

HCl/Cl_2 levels were too low to be reliably measured.

b

Presence questionable - reported at similar levels in samples and blanks.

c

Insufficient material to analyze.

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Table B-2. AEC Training Ordnance Emission Factors for VOC

Compound (a)	Simulator Booby Trap Flash M117, Average NEW, lb = 0.22, Average Number of Items = 29				Simulator Flash Artillery M110, Average NEW, lb = 0.19, Average Number of Items = 1				Simulator Hand Grenade, Average NEW, lb = 0.32, Average Number of Items = 4			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Total Nonmethane Hydrocarbons (TNMHC)												
TNMHC	9.070E-02	4.600E-02	4.949E-04	3.811E-06	2.267E+00	1.760E-01	2.598E-02	4.871E-03	9.160E-02	2.310E-02	5.134E-04	4.159E-05
Volatile Organic Compounds (VOCs)												
Ethane	3.300E-03	6.500E-03	ND	ND	1.550E-03	2.300E-03	ND	ND	5.700E-03	2.900E-03	2.121E-05	1.718E-06
Ethylene	8.250E-03	2.600E-03	6.256E-05	4.817E-07	2.045E-02	3.000E-04	2.500E-04	4.688E-05	1.275E-02	1.500E-04	9.449E-05	7.653E-06
Acetylene	1.255E-02	3.200E-03	1.035E-04	7.971E-07	7.800E-03	7.500E-04	8.746E-05	1.640E-05	1.295E-02	9.500E-04	9.005E-05	7.294E-06
Propane	1.300E-03	2.600E-03	ND	ND	7.500E-04	1.000E-03	0.000E+00	0.000E+00	2.400E-03	1.900E-03	3.723E-06	3.016E-07
Propene	2.100E-03	3.100E-03	ND	ND	9.300E-03	1.000E-04	1.141E-04	2.140E-05	4.300E-03	1.000E-04	3.188E-05	2.583E-06
i-Butane	2.500E-04	4.000E-04	ND	ND	3.150E-03	3.000E-04	3.537E-05	6.631E-06	4.500E-04	4.000E-04	1.472E-06	1.192E-07
i-Butene	2.000E-04	8.000E-04	ND	ND	5.900E-03	1.000E-04	7.261E-05	1.361E-05	7.500E-04	ND	5.564E-06	4.507E-07
1-Butene	4.500E-04	1.300E-03	ND	ND	2.300E-03	1.000E-04	2.791E-05	5.234E-06	5.000E-04	ND	3.766E-06	3.051E-07
1,3-Butadiene	9.000E-04	2.000E-04	7.750E-06	5.968E-08	1.850E-03	ND	2.296E-05	4.304E-06	2.500E-04	ND	1.883E-06	1.525E-07
n-Butane	4.000E-04	1.100E-03	ND	ND	1.565E-02	5.000E-04	1.881E-04	3.528E-05	8.500E-04	8.500E-04	ND	ND
trans-2-Butene	1.200E-03	2.000E-04	1.107E-05	8.525E-08	1.600E-03	ND	1.985E-05	3.722E-06	7.500E-04	ND	5.628E-06	4.559E-07
2,2-Dimethylpropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-2-Butene	1.000E-04	2.000E-04	ND	ND	5.000E-04	ND	6.203E-06	1.163E-06	1.500E-04	ND	1.126E-06	9.117E-08
3-Methyl-1-butene	ND	1.000E-04	ND	ND	4.000E-04	ND	4.962E-06	9.304E-07	ND	ND	ND	ND
i-Pentane	9.000E-04	5.000E-04	4.429E-06	3.410E-08	8.240E-02	1.250E-03	1.008E-03	1.891E-04	4.500E-04	3.000E-04	1.147E-06	9.291E-08
1-Pentene	ND	ND	ND	ND	8.000E-04	ND	9.924E-06	1.861E-06	ND	ND	ND	ND
2-Methyl-1-butene	ND	3.000E-04	ND	ND	1.150E-03	ND	1.428E-05	2.677E-06	1.000E-04	ND	7.361E-07	5.962E-08
n-Pentane	8.000E-04	5.000E-04	3.322E-06	2.558E-08	8.410E-02	1.300E-03	1.029E-03	1.929E-04	3.500E-04	3.000E-04	7.361E-07	5.962E-08
Isoprene	ND	1.000E-04	ND	ND	1.000E-04	ND	1.241E-06	2.326E-07	ND	2.000E-04	ND	ND
trans-2-Pentene	ND	1.000E-04	ND	ND	7.500E-04	ND	9.310E-06	1.746E-06	ND	ND	ND	ND
cis-2-Pentene	ND	ND	ND	ND	4.000E-04	ND	4.966E-06	9.312E-07	ND	ND	ND	ND
2-Methyl-2-butene	ND	ND	ND	ND	4.500E-04	ND	5.580E-06	1.046E-06	ND	ND	ND	ND
2,2-Dimethylbutane	1.000E-04	4.000E-04	ND	ND	7.400E-03	1.500E-04	9.009E-05	1.689E-05	ND	4.000E-04	ND	ND
Cyclopentene	ND	ND	ND	ND	3.500E-04	ND	4.344E-06	8.145E-07	ND	ND	ND	ND
4-Methyl-1-pentene	ND	ND	ND	ND	3.000E-04	ND	3.726E-06	6.986E-07	ND	ND	ND	ND
Cyclopentane	ND	1.000E-04	ND	ND	6.950E-03	1.500E-04	8.450E-05	1.584E-05	ND	ND	ND	ND
2,3-Dimethylbutane	6.000E-04	1.000E-04	5.536E-06	4.263E-08	1.660E-02	4.500E-04	2.007E-04	3.763E-05	ND	ND	ND	ND
cis-4-Methyl-2-pentene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylpentane	1.150E-03	3.000E-04	9.411E-06	7.246E-08	8.440E-02	1.750E-03	1.027E-03	1.926E-04	2.000E-04	1.500E-04	7.361E-07	5.962E-08
3-Methylpentane	8.500E-04	1.000E-04	8.304E-06	6.394E-08	5.960E-02	1.400E-03	7.232E-04	1.356E-04	ND	1.000E-04	ND	ND
2-Methyl-1-pentene	ND	ND	ND	ND	7.000E-04	ND	8.712E-06	1.634E-06	ND	ND	ND	ND
1-Hexene	ND	ND	ND	ND	4.000E-04	ND	4.978E-06	9.335E-07	ND	ND	ND	ND
n-Hexane	1.200E-03	2.000E-04	1.107E-05	8.525E-08	1.002E-01	2.600E-03	1.213E-03	2.274E-04	2.000E-04	1.000E-04	7.576E-07	6.136E-08
trans-2-Hexene	ND	ND	ND	ND	5.500E-04	ND	6.829E-06	1.280E-06	ND	ND	ND	ND
2-Methyl-2-pentene	ND	ND	ND	ND	4.500E-04	ND	5.580E-06	1.046E-06	ND	ND	ND	ND
cis-2-Hexene	ND	ND	ND	ND	3.000E-04	ND	3.726E-06	6.986E-07	ND	ND	ND	ND
Methylcyclopentane	5.000E-04	2.000E-04	3.322E-06	2.558E-08	3.665E-02	1.150E-03	4.411E-04	8.271E-05	1.000E-04	1.000E-04	ND	ND
2,4-Dimethylpentane	1.250E-03	1.000E-04	1.273E-05	9.804E-08	1.025E-02	7.500E-04	1.180E-04	2.213E-05	1.000E-04	1.000E-04	ND	ND
Benzene	4.750E-03	7.000E-04	4.484E-05	3.453E-07	8.735E-02	3.100E-03	1.047E-03	1.963E-04	2.950E-03	5.500E-04	1.801E-05	1.459E-06
Cyclohexane	3.000E-04	4.000E-04	ND	ND	4.375E-02	1.200E-03	5.287E-04	9.913E-05	ND	1.000E-04	ND	ND

Table B-2. (Continued)

Compound (a)	Simulator Booby Trap Flash M117				Simulator Flash Artillery M110				Simulator Hand Grenade			
	Average NEW, lb = 0.22				Average NEW, lb = 0.19				Average NEW, lb = 0.32			
	Average Number of Items = 29				Average Number of Items = 1				Average Number of Items = 4			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
2-Methylhexane	4.000E-04	1.000E-04	3.322E-06	2.558E-08	5.330E-02	1.750E-03	6.404E-04	1.201E-04	ND	1.000E-04	ND	ND
2,3-Dimethylpentane	2.300E-03	2.000E-04	2.325E-05	1.790E-07	1.705E-02	1.550E-03	1.927E-04	3.613E-05	ND	1.000E-04	ND	ND
3-Methylhexane	5.500E-04	4.000E-04	1.661E-06	1.279E-08	5.790E-02	1.950E-03	6.951E-04	1.303E-04	ND	2.500E-04	ND	ND
2,2,4-Trimethylpentane	4.450E-03	5.000E-04	4.373E-05	3.367E-07	1.630E-02	2.150E-03	1.759E-04	3.297E-05	6.000E-04	2.000E-04	3.009E-06	2.437E-07
n-Heptane	4.000E-04	2.000E-04	2.214E-06	1.705E-08	7.575E-02	2.650E-03	9.082E-04	1.703E-04	2.000E-04	1.000E-04	7.361E-07	5.962E-08
2,4,4-Trimethyl-1-pentene	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.000E-04	ND	ND
Methylcyclohexane	2.000E-04	1.000E-04	1.107E-06	8.525E-09	7.710E-02	2.450E-03	9.275E-04	1.739E-04	ND	ND	ND	ND
2,4,4-Trimethyl-2-pentene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,5-Dimethylhexane	3.000E-04	ND	3.322E-06	2.558E-08	7.900E-03	4.500E-04	9.251E-05	1.735E-05	ND	ND	ND	ND
2,4-Dimethylhexane	4.500E-04	ND	4.982E-06	3.836E-08	9.100E-03	4.500E-04	1.075E-04	2.015E-05	ND	ND	ND	ND
2,3,4-Trimethylpentane	9.000E-04	1.000E-04	8.857E-06	6.820E-08	2.950E-03	5.000E-04	3.043E-05	5.706E-06	1.000E-04	1.000E-04	ND	ND
Toluene	3.000E-03	8.000E-04	2.436E-05	1.876E-07	2.225E-01	1.890E-02	2.528E-03	4.739E-04	1.600E-03	5.000E-04	8.269E-06	6.698E-07
2,3-Dimethylhexane	4.000E-04	ND	4.429E-06	3.410E-08	4.650E-03	3.500E-04	5.342E-05	1.002E-05	ND	ND	ND	ND
2-Methylheptane	2.500E-04	ND	2.768E-06	2.131E-08	2.435E-02	7.500E-04	2.932E-04	5.497E-05	ND	ND	ND	ND
3-Ethylhexane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,2-Dimethylheptane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,2,4-Trimethylhexane	3.000E-04	ND	3.322E-06	2.558E-08	2.100E-03	5.500E-04	1.924E-05	3.608E-06	ND	ND	ND	ND
n-Octane	1.500E-04	1.000E-04	5.536E-07	4.263E-09	2.795E-02	1.100E-03	3.335E-04	6.254E-05	1.000E-04	1.000E-04	ND	ND
Ethylcyclohexane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	4.000E-04	2.000E-04	2.214E-06	1.705E-08	5.620E-02	4.050E-03	6.478E-04	1.215E-04	4.000E-04	1.000E-04	2.251E-06	1.823E-07
m-Xylene & p-Xylene	9.000E-04	4.000E-04	5.536E-06	4.263E-08	1.576E-01	1.660E-02	1.751E-03	3.284E-04	8.000E-04	5.500E-04	1.883E-06	1.525E-07
Styrene	7.000E-04	ND	7.750E-06	5.968E-08	1.700E-03	2.000E-04	1.863E-05	3.493E-06	4.000E-04	ND	3.116E-06	2.524E-07
o-Xylene	4.000E-04	2.000E-04	2.214E-06	1.705E-08	9.875E-02	9.100E-03	1.114E-03	2.088E-04	5.500E-04	2.000E-04	2.619E-06	2.122E-07
n-Nonane	5.000E-04	ND	5.536E-06	4.263E-08	6.700E-03	1.000E-03	7.701E-05	1.444E-05	3.500E-04	1.000E-04	2.230E-06	1.806E-07
i-Propylbenzene	ND	ND	ND	ND	2.000E-03	ND	2.483E-05	4.657E-06	ND	ND	ND	ND
n-Propylbenzene	ND	ND	ND	ND	1.310E-02	1.700E-03	1.416E-04	2.656E-05	1.000E-04	1.000E-04	7.361E-07	5.962E-08
p-Ethyltoluene	ND	ND	ND	ND	5.335E-02	7.550E-03	5.691E-04	1.067E-04	5.000E-04	3.000E-04	2.619E-06	2.122E-07
m-Ethyltoluene	ND	ND	ND	ND	2.435E-02	3.500E-03	2.591E-04	4.857E-05	3.000E-04	1.000E-04	1.883E-06	1.525E-07
1,3,5-Trimethylbenzene	ND	ND	ND	ND	3.405E-02	5.000E-03	3.609E-04	6.767E-05	4.000E-04	2.000E-04	2.251E-06	1.823E-07
o-Ethyltoluene	ND	ND	ND	ND	1.585E-02	2.450E-03	1.665E-04	3.122E-05	3.500E-04	1.000E-04	2.273E-06	1.841E-07
1,2,4-Trimethylbenzene & sec-Butylbenzene	3.000E-04	1.000E-04	2.214E-06	1.705E-08	8.480E-02	1.570E-02	8.587E-04	1.610E-04	1.000E-03	3.000E-04	5.303E-06	4.295E-07
n-Decane	ND	ND	ND	ND	1.900E-03	5.000E-04	2.050E-05	3.844E-06	2.000E-04	1.000E-04	7.790E-07	6.310E-08
alpha-Pinene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
beta-Pinene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
delta 3-Carene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
d-Limonene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MTBE	1.100E-03	4.000E-04	7.750E-06	5.968E-08	9.000E-02	2.150E-03	1.092E-03	2.047E-04	ND	ND	ND	ND
ETBE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	1.520E-03	3.698E-04	1.274E-05	9.807E-08	2.399E-03	1.434E-03	1.199E-05	2.248E-06	1.215E-03	9.510E-04	1.967E-06	1.593E-07
Methylchloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethene	1.492E-04	ND	1.652E-06	1.272E-08	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Butadiene	9.154E-04	2.034E-04	7.883E-06	6.070E-08	1.882E-02	ND	2.335E-04	4.378E-05	2.543E-04	ND	1.915E-06	1.551E-07
Methylbromide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-2. (Continued)

Compound (a)	Simulator Booby Trap Flash M117				Simulator Flash Artillery M110				Simulator Hand Grenade			
	Average NEW, lb = 0.22				Average NEW, lb = 0.19				Average NEW, lb = 0.32			
	Average Number of Items = 29				Average Number of Items = 1				Average Number of Items = 4			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Ethylchloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloromonofluoromethane	2.482E-03	ND	2.748E-05	2.116E-07	2.264E-03	2.506E-03	ND	ND	2.441E-03	2.527E-03	ND	ND
Vinylidenechloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylenechloride	5.830E-03	4.948E-04	5.907E-05	4.548E-07	8.685E-03	9.779E-04	9.577E-05	1.796E-05	6.838E-03	6.733E-04	4.711E-05	3.816E-06
Allylchloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	8.615E-04	8.561E-04	5.961E-08	4.590E-10	6.602E-04	8.291E-04	ND	ND	7.966E-04	8.874E-04	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylchloroform	3.770E-04	3.374E-04	4.381E-07	3.374E-09	3.192E-04	3.562E-04	ND	ND	3.535E-04	3.485E-04	3.777E-08	3.059E-09
Benzene	4.831E-03	7.120E-04	4.561E-05	3.512E-07	8.885E-01	3.153E-03	1.100E-02	2.062E-03	3.001E-03	5.594E-04	1.832E-05	1.484E-06
Carbontetrachloride	7.722E-04	6.288E-04	1.588E-06	1.223E-08	5.539E-04	7.588E-04	ND	ND	7.652E-04	7.138E-04	3.828E-07	3.100E-08
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis 1,3-Dichloro-1-propene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans 1,3-Dichloro-1-propene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	3.051E-03	8.137E-04	2.477E-05	1.908E-07	2.263E+00	1.922E-02	2.785E-02	5.221E-03	1.627E-03	5.086E-04	8.410E-06	6.812E-07
1,2-Dibromoethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perchloroethylene	ND	ND	ND	ND	4.875E-02	ND	6.068E-04	1.138E-04	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	6.141E-04	ND	6.799E-06	5.235E-08	8.628E-01	6.218E-03	1.064E-02	1.995E-03	6.141E-04	ND	4.619E-06	3.742E-07
m&p-Xylene	8.197E-04	3.658E-04	5.025E-06	3.870E-08	1.602E+00	1.677E-02	1.969E-02	3.692E-03	1.033E-03	5.045E-04	3.978E-06	3.222E-07
Styrene	3.721E-04	ND	4.120E-06	3.172E-08	1.266E-02	2.439E-04	1.535E-04	2.878E-05	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	4.068E-04	ND	4.505E-06	3.468E-08	1.004E+00	9.256E-03	1.236E-02	2.317E-03	5.594E-04	ND	4.205E-06	3.406E-07
p-Ethyltoluene	ND	ND	ND	ND	3.565E-01	1.673E-02	4.323E-03	8.105E-04	3.140E-04	ND	2.378E-06	1.926E-07
1,3,5-Trimethylbenzene	ND	ND	ND	ND	3.430E-01	7.637E-03	4.212E-03	7.898E-04	ND	ND	ND	ND
1,2,4-Trimethylbenzene	3.255E-04	ND	3.604E-06	2.775E-08	6.724E-01	1.519E-02	8.161E-03	1.530E-03	7.515E-04	5.401E-04	1.587E-06	1.285E-07
Benzylchloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
m-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenylacetylene	2.424E-04	ND	2.684E-06	2.066E-08	ND	6.579E-04	ND	ND	ND	ND	ND	ND
Indane	ND	ND	ND	ND	1.499E-01	6.217E-03	1.823E-03	3.417E-04	ND	ND	ND	ND
2,3-Dihydro-1-methyl-1H-indene	ND	ND	ND	ND	4.698E-02	3.747E-03	5.599E-04	1.050E-04	ND	ND	ND	ND
2,3-Dihydro-4-methyl-1H-indene	ND	ND	ND	ND	5.934E-02	4.893E-03	7.063E-04	1.324E-04	ND	ND	ND	ND
Naphthalene	7.156E-04	ND	7.923E-06	6.101E-08	7.060E-02	7.803E-03	8.284E-04	1.553E-04	9.827E-04	5.793E-04	3.033E-06	2.457E-07
2-Methylnaphthalene	ND	ND	ND	ND	9.285E-03	2.818E-03	1.156E-04	2.167E-05	ND	ND	ND	ND
1-Methylnaphthalene	ND	ND	ND	ND	ND	1.102E-03	ND	ND	ND	ND	ND	ND
Cyanogen	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-2. (Continued)

Compound (a)	Simulator Booby Trap Flash M117 Average NEW, lb = 0.22 Average Number of Items = 29				Simulator Flash Artillery M110 Average NEW, lb = 0.19 Average Number of Items = 1				Simulator Hand Grenade Average NEW, lb = 0.32 Average Number of Items = 4			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Methylnitrite	6.177E-04	ND	6.839E-06	5.266E-08	3.564E-02	ND	4.419E-04	8.286E-05	1.411E-03	ND	1.061E-05	8.595E-07
Acetonitrile	3.440E-04	ND	3.808E-06	2.932E-08	ND	ND	ND	ND	1.220E-04	ND	9.169E-07	7.427E-08
Acrylonitrile	2.985E-04	ND	3.305E-06	2.545E-08	ND	ND	ND	ND	9.772E-04	ND	7.612E-06	6.166E-07
Nitromethane	6.873E-04	ND	7.609E-06	5.859E-08	5.490E-03	8.363E-04	6.289E-05	1.179E-05	1.219E-03	ND	9.196E-06	7.449E-07
Propanenitrile	ND	ND	ND	ND	ND	ND	ND	ND	1.324E-04	ND	9.743E-07	7.892E-08
2-Methylpropanenitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentanenitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexanenitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzonitrile	2.302E-04	ND	2.549E-06	1.963E-08	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acrolein	1.874E-03	ND	2.075E-05	1.598E-07	7.579E-03	ND	9.402E-05	1.763E-05	2.765E-03	ND	2.078E-05	1.683E-06
Acetone	6.650E-03	5.352E-03	1.437E-05	1.107E-07	2.153E-02	5.169E-03	1.849E-04	3.467E-05	8.855E-03	8.869E-03	4.104E-05	3.324E-06
1-Hydroxy-2-propanone	ND	ND	ND	ND	ND	ND	ND	ND	2.545E-03	1.136E-03	1.534E-05	1.243E-06
Furan	1.779E-04	ND	1.970E-06	1.517E-08	ND	ND	ND	ND	5.324E-04	ND	3.991E-06	3.232E-07
2-Propanol	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.513E-02	ND	ND
2-Methylpropanal	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Propanol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methacrolein	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl-vinyl Ketone	ND	ND	ND	ND	ND	ND	ND	ND	3.856E-04	ND	2.899E-06	2.348E-07
MTBE	1.034E-03	1.839E-04	9.414E-06	7.249E-08	9.149E-01	2.181E-03	1.134E-02	2.126E-03	ND	ND	ND	ND
2,3-Butanedione	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butanal	3.928E-04	3.210E-04	7.948E-07	6.120E-09	ND	2.451E-04	ND	ND	2.586E-04	2.322E-04	3.889E-07	3.150E-08
2-Butanone	1.568E-03	8.692E-04	7.732E-06	5.954E-08	1.013E-02	7.607E-04	1.164E-04	2.182E-05	1.639E-03	7.609E-04	6.595E-06	5.342E-07
2-Methyl-1,3-dioxolane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylfuran	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrahydrofuran	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-2-Butenal	3.977E-04	ND	4.403E-06	3.391E-08	ND	ND	ND	ND	3.566E-04	ND	2.686E-06	2.175E-07
Acetic Acid	2.832E-03	8.137E-04	2.234E-05	1.720E-07	2.121E-02	1.627E-03	2.431E-04	4.559E-05	1.987E-03	2.458E-03	1.526E-06	1.236E-07
1-Butanol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Pentanone	2.989E-04	2.374E-04	6.810E-07	5.244E-09	ND	ND	ND	ND	2.863E-04	ND	2.108E-06	1.707E-07
Pentanal	1.645E-03	1.306E-03	3.759E-06	2.894E-08	ND	1.159E-03	ND	ND	8.800E-04	1.022E-03	ND	ND
1,4-Dioxane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl Methacrylate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyclopentanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexanal	1.330E-03	9.985E-04	3.666E-06	2.822E-08	ND	1.143E-03	ND	ND	5.378E-04	5.402E-04	4.420E-08	3.581E-09
2-Furaldehyde	1.307E-03	4.095E-04	9.938E-06	7.652E-08	ND	ND	ND	ND	2.111E-03	ND	1.589E-05	1.287E-06
Cyclohexanone	2.235E-04	ND	2.475E-06	1.906E-08	ND	ND	ND	ND	ND	ND	ND	ND
Heptanal	1.293E-03	8.661E-04	4.732E-06	3.643E-08	6.326E-03	1.027E-03	6.579E-05	1.233E-05	5.654E-04	6.054E-04	5.373E-07	4.352E-08
2-Butoxyethanol	ND	ND	ND	ND	ND	ND	ND	ND	6.911E-04	7.468E-04	ND	ND
Benzaldehyde	2.277E-03	1.153E-03	1.245E-05	9.586E-08	4.159E-02	1.868E-03	4.927E-04	9.238E-05	2.144E-03	9.684E-04	8.850E-06	7.169E-07
6-Methyl-5-hepten-2-one	ND	ND	ND	ND	ND	6.854E-04	ND	ND	ND	1.540E-03	ND	ND
Octanal	3.105E-03	2.207E-03	9.949E-06	7.661E-08	1.674E-02	2.349E-03	1.787E-04	3.350E-05	1.208E-03	1.242E-03	2.621E-06	2.123E-07
Benzofuran	ND	ND	ND	ND	ND	ND	ND	ND	3.581E-04	ND	2.636E-06	2.135E-07
2-Ethyl-1-hexanol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-2. (Continued)

Compound (a)	Simulator Booby Trap Flash M117 Average NEW, lb = 0.22 Average Number of Items = 29				Simulator Flash Artillery M110 Average NEW, lb = 0.19 Average Number of Items = 1				Simulator Hand Grenade Average NEW, lb = 0.32 Average Number of Items = 4			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Acetophonone	3.716E-04	ND	4.114E-06	3.168E-08	ND	ND	ND	ND	3.193E-04	ND	2.429E-06	1.968E-07
Nonanal	4.906E-03	2.870E-03	2.254E-05	1.735E-07	2.354E-02	4.077E-03	2.418E-04	4.533E-05	1.597E-03	1.812E-03	ND	ND
Decanal	4.607E-03	3.192E-03	1.567E-05	1.206E-07	1.982E-02	2.462E-03	2.157E-04	4.044E-05	1.522E-03	2.042E-03	ND	ND
Carbonyl Sulfide	3.974E-04	2.525E-04	1.604E-06	1.235E-08	2.482E-03	2.681E-04	2.746E-05	5.149E-06	4.419E-04	1.790E-04	1.977E-06	1.602E-07
Carbon Disulfide	3.460E-02	1.143E-03	3.705E-04	2.852E-06	8.522E-03	5.882E-04	9.828E-05	1.843E-05	8.951E-02	6.089E-04	6.701E-04	5.428E-05
Thiophene	4.147E-04	ND	4.591E-06	3.535E-08	ND	ND	ND	ND	4.281E-04	ND	3.224E-06	2.611E-07
Dimethyldisulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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Items in bold represent duplicate values for those compounds that are common for Method TO-14 and TO-12.

Table B-2. (Continued)

Compound (a)	Simulator Ground Burst Average NEW, lb = 0.35 Average Number of Items = 2.5				Green Star Cluster Signal Flare Average NEW, lb = 1.67 Average Number of Items = 1				Green Parachute Signal Flare Average NEW, lb = 0.32 Average Number of Items = 1			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Total Nonmethane Hydrocarbons (TNMHC)												
TNMHC	1.580E-01	2.165E-02	9.076E-04	1.271E-04	1.486E-01	3.600E-02	1.519E-04	2.535E-04	1.380E-01	6.070E-02	5.537E-04	1.750E-04
Volatile Organic Compounds (VOCs)												
Ethane	3.150E-03	2.700E-03	3.392E-06	4.749E-07	5.700E-03	2.800E-03	3.912E-06	6.529E-06	5.000E-03	1.900E-03	2.222E-05	7.021E-06
Ethylene	3.545E-02	1.000E-04	2.314E-04	3.239E-05	2.380E-02	2.000E-04	3.183E-05	5.313E-05	2.605E-02	8.000E-04	1.810E-04	5.719E-05
Acetylene	4.445E-02	7.000E-04	2.881E-04	4.033E-05	2.570E-02	8.000E-04	3.359E-05	5.606E-05	1.390E-02	2.800E-03	7.956E-05	2.514E-05
Propane	2.300E-03	1.650E-03	4.338E-06	6.074E-07	2.400E-03	1.300E-03	1.484E-06	2.476E-06	1.900E-03	1.400E-03	3.584E-06	1.132E-06
Propene	7.700E-03	ND	5.029E-05	7.040E-06	8.300E-03	ND	1.120E-05	1.869E-05	7.650E-03	7.000E-04	4.982E-05	1.574E-05
i-Butane	4.500E-04	4.000E-04	8.560E-07	1.198E-07	3.000E-04	3.000E-04	ND	ND	4.000E-04	4.000E-04	ND	ND
i-Butene	6.500E-04	ND	4.032E-06	5.645E-07	7.000E-04	ND	9.442E-07	1.576E-06	9.500E-04	4.000E-04	3.942E-06	1.246E-06
1-Butene	1.200E-03	ND	7.668E-06	1.073E-06	1.300E-03	ND	1.754E-06	2.927E-06	2.350E-03	2.000E-04	1.541E-05	4.870E-06
1,3-Butadiene	1.050E-03	ND	6.843E-06	9.580E-07	1.600E-03	ND	2.158E-06	3.602E-06	1.750E-03	2.000E-04	1.111E-05	3.511E-06
n-Butane	7.000E-04	7.500E-04	ND	ND	7.000E-04	5.000E-04	2.698E-07	4.503E-07	1.250E-03	1.100E-03	1.075E-06	3.397E-07
trans-2-Butene	2.650E-03	ND	1.732E-05	2.425E-06	1.400E-03	ND	1.888E-06	3.152E-06	1.100E-03	3.000E-04	5.734E-06	1.812E-06
2,2-Dimethylpropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-2-Butene	2.000E-04	ND	1.252E-06	1.753E-07	4.000E-04	ND	5.396E-07	9.005E-07	3.000E-04	1.000E-04	1.434E-06	4.530E-07
3-Methyl-1-butene	2.000E-04	ND	1.099E-06	1.539E-07	1.000E-04	ND	1.349E-07	2.251E-07	1.000E-04	ND	7.168E-07	2.265E-07
i-Pentane	4.500E-04	3.500E-04	7.028E-07	9.839E-08	5.000E-04	8.000E-04	ND	ND	1.500E-03	1.600E-03	ND	ND
1-Pentene	ND	ND	ND	ND	2.000E-04	ND	2.698E-07	4.503E-07	4.000E-04	ND	2.867E-06	9.060E-07
2-Methyl-1-butene	ND	ND	ND	ND	2.000E-04	ND	2.698E-07	4.503E-07	1.500E-04	ND	1.075E-06	3.397E-07
n-Pentane	4.000E-04	2.500E-04	9.776E-07	1.369E-07	8.000E-04	8.000E-04	ND	ND	1.650E-03	1.600E-03	3.584E-07	1.132E-07
Isoprene	ND	1.000E-04	ND	ND	ND	ND	ND	ND	1.000E-04	2.000E-04	ND	ND
trans-2-Pentene	ND	ND	ND	ND	ND	ND	ND	ND	2.000E-04	ND	1.434E-06	4.530E-07
cis-2-Pentene	ND	ND	ND	ND	ND	ND	ND	ND	2.000E-04	ND	1.434E-06	4.530E-07
2-Methyl-2-butene	ND	ND	ND	ND	ND	ND	ND	ND	1.000E-04	ND	7.168E-07	2.265E-07
2,2-Dimethylbutane	2.000E-04	1.000E-04	1.099E-06	1.539E-07	1.000E-04	1.000E-04	ND	ND	2.000E-04	6.000E-04	ND	ND
Cyclopentene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-1-pentene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyclopentane	ND	ND	ND	ND	ND	1.000E-04	ND	ND	ND	1.000E-04	ND	ND
2,3-Dimethylbutane	ND	ND	ND	ND	4.000E-04	3.000E-04	1.349E-07	2.251E-07	6.500E-04	5.000E-04	1.075E-06	3.397E-07
cis-4-Methyl-2-pentene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylpentane	2.000E-04	1.000E-04	7.028E-07	9.839E-08	7.000E-04	7.000E-04	ND	ND	1.400E-03	1.900E-03	ND	ND
3-Methylpentane	ND	1.000E-04	ND	ND	8.000E-04	5.000E-04	4.047E-07	6.754E-07	3.000E-04	1.000E-03	ND	ND
2-Methyl-1-pentene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Hexene	1.000E-04	ND	5.496E-07	7.694E-08	1.000E-03	ND	1.349E-06	2.251E-06	3.500E-04	ND	2.509E-06	7.927E-07
n-Hexane	2.000E-04	2.000E-04	ND	ND	7.000E-04	7.000E-04	ND	ND	1.500E-03	1.600E-03	ND	ND
trans-2-Hexene	ND	ND	ND	ND	ND	ND	ND	ND	1.000E-04	ND	7.168E-07	2.265E-07
2-Methyl-2-pentene	ND	ND	ND	ND	ND	ND	ND	ND	1.000E-04	ND	7.168E-07	2.265E-07
cis-2-Hexene	ND	ND	ND	ND	ND	ND	ND	ND	1.000E-04	ND	7.168E-07	2.265E-07
Methylcyclopentane	1.000E-04	1.000E-04	ND	ND	3.000E-04	3.000E-04	ND	ND	5.500E-04	6.000E-04	ND	ND
2,4-Dimethylpentane	2.000E-04	1.000E-04	9.776E-07	1.369E-07	8.000E-04	7.000E-04	1.349E-07	2.251E-07	1.100E-03	1.000E-03	7.168E-07	2.265E-07
Benzene	9.900E-03	5.500E-04	6.211E-05	8.696E-06	8.500E-03	1.000E-03	1.012E-05	1.689E-05	8.050E-03	2.300E-03	4.121E-05	1.302E-05
Cyclohexane	ND	ND	ND	ND	2.000E-04	2.000E-04	ND	ND	5.000E-04	6.000E-04	ND	ND

Table B-2. (Continued)

Compound (a)	Simulator Ground Burst Average NEW, lb = 0.35 Average Number of Items = 2.5				Green Star Cluster Signal Flare Average NEW, lb = 1.67 Average Number of Items = 1				Green Parachute Signal Flare Average NEW, lb = 0.32 Average Number of Items = 1			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
2-Methylhexane	ND	ND	ND	ND	ND	3.000E-04	ND	ND	7.500E-04	7.000E-04	3.584E-07	1.132E-07
2,3-Dimethylpentane	ND	1.000E-04	ND	ND	ND	1.500E-03	ND	ND	2.150E-03	2.100E-03	3.584E-07	1.132E-07
3-Methylhexane	ND	2.000E-04	ND	ND	ND	4.000E-04	ND	ND	7.500E-04	1.000E-03	ND	ND
2,2,4-Trimethylpentane	7.500E-04	3.500E-04	2.964E-06	4.150E-07	2.900E-03	2.900E-03	ND	ND	4.100E-03	4.200E-03	ND	ND
n-Heptane	2.000E-04	1.000E-04	8.560E-07	1.198E-07	3.000E-04	2.000E-04	1.349E-07	2.251E-07	7.000E-04	7.000E-04	ND	ND
2,4,4-Trimethyl-1-pentene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylcyclohexane	ND	ND	ND	ND	2.000E-04	2.000E-04	ND	ND	4.500E-04	5.000E-04	ND	ND
2,4,4-Trimethyl-2-pentene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,5-Dimethylhexane	1.000E-04	1.000E-04	8.560E-07	1.198E-07	2.000E-04	2.000E-04	ND	ND	3.500E-04	4.000E-04	ND	ND
2,4-Dimethylhexane	1.500E-04	1.000E-04	7.028E-07	9.839E-08	3.000E-04	4.000E-04	ND	ND	5.000E-04	5.000E-04	ND	ND
2,3,4-Trimethylpentane	1.500E-04	1.000E-04	1.099E-06	1.539E-07	7.000E-04	7.000E-04	ND	ND	1.000E-03	1.000E-03	ND	ND
Toluene	2.500E-03	6.000E-04	1.274E-05	1.784E-06	4.300E-03	2.200E-03	2.833E-06	4.728E-06	5.700E-03	5.000E-03	5.017E-06	1.585E-06
2,3-Dimethylhexane	ND	ND	ND	ND	2.000E-04	3.000E-04	ND	ND	3.500E-04	4.000E-04	ND	ND
2-Methylheptane	ND	ND	ND	ND	ND	1.000E-04	ND	ND	4.500E-04	2.000E-04	1.792E-06	5.662E-07
3-Ethylhexane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,2-Dimethylheptane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,2,4-Trimethylhexane	2.000E-04	ND	1.099E-06	1.539E-07	2.000E-04	1.000E-04	1.349E-07	2.251E-07	1.000E-04	2.000E-04	ND	ND
n-Octane	1.000E-04	ND	5.496E-07	7.694E-08	2.000E-04	1.000E-04	1.349E-07	2.251E-07	3.000E-04	2.000E-04	7.168E-07	2.265E-07
Ethylcyclohexane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	5.000E-04	1.000E-04	2.811E-06	3.936E-07	5.000E-04	2.000E-04	4.047E-07	6.754E-07	6.500E-04	5.000E-04	1.075E-06	3.397E-07
m-Xylene & p-Xylene	1.500E-03	6.500E-04	5.897E-06	8.256E-07	1.700E-03	1.200E-03	6.745E-07	1.126E-06	2.850E-03	2.500E-03	2.509E-06	7.927E-07
Styrene	5.500E-04	ND	3.636E-06	5.090E-07	7.000E-04	ND	9.442E-07	1.576E-06	4.500E-04	5.000E-04	ND	ND
o-Xylene	6.500E-04	2.500E-04	2.811E-06	3.936E-07	8.000E-04	4.000E-04	5.396E-07	9.005E-07	1.050E-03	9.000E-04	1.075E-06	3.397E-07
n-Nonane	4.500E-04	ND	3.239E-06	4.535E-07	4.000E-04	ND	5.396E-07	9.005E-07	1.500E-04	ND	1.075E-06	3.397E-07
i-Propylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	1.500E-04	1.000E-04	1.712E-06	2.397E-07	2.000E-04	1.000E-04	1.349E-07	2.251E-07	2.500E-04	2.000E-04	3.584E-07	1.132E-07
p-Ethyltoluene	5.000E-04	3.000E-04	2.690E-06	3.765E-07	1.100E-03	3.000E-04	1.079E-06	1.801E-06	1.000E-03	6.000E-04	2.867E-06	9.060E-07
m-Ethyltoluene	2.500E-04	1.000E-04	1.406E-06	1.968E-07	5.000E-04	1.000E-04	5.396E-07	9.005E-07	3.500E-04	2.000E-04	1.075E-06	3.397E-07
1,3,5-Trimethylbenzene	3.500E-04	2.000E-04	1.834E-06	2.567E-07	4.000E-04	2.000E-04	2.698E-07	4.503E-07	4.500E-04	3.000E-04	1.075E-06	3.397E-07
o-Ethyltoluene	2.000E-04	ND	1.406E-06	1.968E-07	4.000E-04	1.000E-04	4.047E-07	6.754E-07	3.500E-04	2.000E-04	1.075E-06	3.397E-07
1,2,4-Trimethylbenzene & sec-Butylbenzene	1.150E-03	5.500E-04	4.064E-06	5.689E-07	1.000E-03	6.000E-04	5.396E-07	9.005E-07	1.150E-03	8.000E-04	2.509E-06	7.927E-07
n-Decane	1.000E-04	ND	8.560E-07	1.198E-07	1.000E-04	1.000E-04	ND	ND	2.000E-04	1.000E-04	7.168E-07	2.265E-07
alpha-Pinene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
beta-Pinene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
delta 3-Carene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
d-Limonene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MTBE	ND	ND	ND	ND	4.000E-04	4.000E-04	ND	ND	9.000E-04	7.000E-04	1.434E-06	4.530E-07
ETBE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	1.055E-03	1.413E-03	ND	ND	1.398E-03	1.179E-03	2.951E-07	4.925E-07	1.482E-03	1.130E-03	2.524E-06	7.976E-07
Methylchloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Butadiene	1.068E-03	ND	6.960E-06	9.744E-07	1.627E-03	ND	2.195E-06	3.664E-06	1.780E-03	2.034E-04	1.130E-05	3.571E-06
Methylbromide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-2. (Continued)

Compound (a)	Simulator Ground Burst, Average NEW, lb = 0.35, Average Number of Items = 2.5: Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Green Star Cluster Signal Flare, Average NEW, lb = 1.67, Average Number of Items = 1: Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Green Parachute Signal Flare, Average NEW, lb = 0.32, Average Number of Items = 1: Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Ethylchloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloromonofluoromethane	2.500E-03	2.517E-03	ND	ND	2.495E-03	2.434E-03	8.127E-08	1.356E-07	2.576E-03	2.533E-03	3.040E-07	9.606E-08
Vinylidenechloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylenechloride	8.883E-03	3.194E-04	6.325E-05	8.855E-06	4.153E-02	2.283E-04	5.571E-05	9.298E-05	5.547E-02	8.068E-04	3.918E-04	1.238E-04
Allylchloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	8.561E-04	8.324E-04	1.343E-07	1.881E-08	8.335E-04	8.665E-04	ND	ND	8.817E-04	8.258E-04	4.005E-07	1.266E-07
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylchloroform	3.641E-04	3.521E-04	9.385E-08	1.314E-08	3.759E-04	3.490E-04	3.628E-08	6.056E-08	3.897E-04	3.482E-04	2.975E-07	9.400E-08
Benzene	1.007E-02	5.594E-04	6.317E-05	8.844E-06	8.646E-03	1.017E-03	1.029E-05	1.717E-05	8.188E-03	2.339E-03	4.192E-05	1.325E-05
Carbontetrachloride	8.171E-04	7.262E-04	6.964E-07	9.750E-08	7.904E-04	6.758E-04	1.546E-07	2.580E-07	8.360E-04	7.072E-04	9.234E-07	2.918E-07
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis 1,3-Dichloro-1-propene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans 1,3-Dichloro-1-propene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	2.543E-03	6.103E-04	1.296E-05	1.814E-06	4.374E-03	2.238E-03	2.881E-06	4.809E-06	5.798E-03	5.086E-03	5.103E-06	1.613E-06
1,2-Dibromoethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perchloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	7.676E-04	ND	5.395E-06	7.553E-07	7.676E-04	ND	1.035E-06	1.728E-06	9.979E-04	7.676E-04	1.651E-06	5.216E-07
m&p-Xylene	1.444E-03	5.892E-04	5.929E-06	8.301E-07	1.798E-03	1.121E-03	9.137E-07	1.525E-06	2.859E-03	2.390E-03	3.358E-06	1.061E-06
Styrene	3.956E-04	ND	2.174E-06	3.044E-07	2.975E-04	ND	4.013E-07	6.697E-07	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	6.611E-04	3.051E-04	3.730E-06	5.222E-07	8.137E-04	4.068E-04	5.488E-07	9.160E-07	1.068E-03	9.154E-04	1.094E-06	3.456E-07
p-Ethyltoluene	4.417E-04	ND	3.040E-06	4.255E-07	3.914E-04	ND	5.279E-07	8.811E-07	5.413E-04	4.433E-04	7.024E-07	2.219E-07
1,3,5-Trimethylbenzene	3.074E-04	ND	1.689E-06	2.365E-07	2.552E-04	ND	3.443E-07	5.746E-07	3.447E-04	2.679E-04	5.511E-07	1.742E-07
1,2,4-Trimethylbenzene	8.833E-04	5.112E-04	2.840E-06	3.976E-07	8.568E-04	5.425E-04	4.239E-07	7.075E-07	1.097E-03	8.531E-04	1.747E-06	5.519E-07
Benzylchloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
m-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenylacetylene	7.086E-04	ND	4.651E-06	6.511E-07	ND	ND	ND	ND	ND	ND	ND	ND
Indane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3-Dihydro-1-methyl-1H-indene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3-Dihydro-4-methyl-1H-indene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	1.881E-03	4.632E-04	9.565E-06	1.339E-06	1.393E-03	4.069E-04	1.331E-06	2.221E-06	1.276E-03	4.078E-04	6.225E-06	1.967E-06
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyanogen	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-2. (Continued)

Compound (a)	Simulator Ground Burst Average NEW, lb = 0.35 Average Number of Items = 2.5				Green Star Cluster Signal Flare Average NEW, lb = 1.67 Average Number of Items = 1				Green Parachute Signal Flare Average NEW, lb = 0.32 Average Number of Items = 1			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Methylnitrite	5.275E-04	ND	3.405E-06	4.767E-07	4.034E-04	ND	5.441E-07	9.082E-07	3.948E-04	ND	2.830E-06	8.941E-07
Acetonitrile	2.806E-04	ND	1.835E-06	2.569E-07	9.500E-04	ND	1.281E-06	2.139E-06	5.775E-04	ND	4.139E-06	1.308E-06
Acrylonitrile	1.886E-04	ND	1.036E-06	1.451E-07	1.900E-03	ND	2.563E-06	4.278E-06	5.531E-04	ND	3.965E-06	1.253E-06
Nitromethane	1.433E-03	ND	9.517E-06	1.332E-06	9.490E-04	ND	1.280E-06	2.137E-06	1.328E-03	ND	9.522E-06	3.009E-06
Propanenitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylpropanenitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentanenitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexanenitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzonitrile	2.555E-04	ND	1.404E-06	1.966E-07	5.134E-04	ND	6.926E-07	1.156E-06	5.671E-04	ND	4.065E-06	1.285E-06
2-Nitrophenol	3.158E-04	ND	2.234E-06	3.127E-07	ND	ND	ND	ND	ND	ND	ND	ND
Acrolein	3.018E-03	ND	1.925E-05	2.695E-06	5.830E-04	ND	7.864E-07	1.313E-06	4.793E-04	ND	3.435E-06	1.086E-06
Acetone	1.343E-02	6.292E-03	4.557E-05	6.379E-06	1.231E-02	8.894E-03	4.611E-06	7.696E-06	1.064E-02	7.510E-03	2.242E-05	7.085E-06
1-Hydroxy-2-propanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Furan	4.167E-04	ND	2.636E-06	3.691E-07	5.863E-04	ND	7.908E-07	1.320E-06	3.231E-04	ND	2.316E-06	7.318E-07
2-Propanol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylpropanal	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Propanol	ND	8.791E-04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methacrolein	2.032E-04	ND	1.117E-06	1.563E-07	ND	ND	ND	ND	ND	ND	ND	ND
Methyl-vinyl Ketone	4.102E-04	ND	2.655E-06	3.717E-07	ND	ND	ND	ND	ND	ND	ND	ND
MTBE	ND	ND	ND	ND	4.995E-04	4.457E-04	7.252E-08	1.210E-07	1.008E-03	9.140E-04	6.708E-07	2.120E-07
2,3-Butanedione	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butanal	3.571E-04	2.684E-04	5.807E-07	8.129E-08	3.698E-04	3.055E-04	8.668E-08	1.447E-07	4.578E-04	3.905E-04	4.826E-07	1.525E-07
2-Butanone	2.235E-03	8.793E-04	1.254E-05	1.756E-06	2.305E-03	9.320E-04	1.852E-06	3.090E-06	1.902E-03	9.694E-04	6.685E-06	2.112E-06
2-Methyl-1,3-dioxolane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylfuran	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrahydrofuran	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-2-Butenal	4.699E-04	ND	3.126E-06	4.377E-07	1.850E-04	ND	2.496E-07	4.166E-07	1.774E-04	ND	1.271E-06	4.018E-07
Acetic Acid	2.106E-03	1.697E-03	5.213E-06	7.298E-07	1.900E-03	1.714E-03	2.499E-07	4.171E-07	2.194E-03	1.131E-03	7.616E-06	2.407E-06
1-Butanol	ND	9.110E-04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Pentanone	4.042E-04	ND	2.696E-06	3.774E-07	4.483E-04	ND	6.048E-07	1.009E-06	6.079E-04	ND	4.357E-06	1.377E-06
Pentanal	1.054E-03	9.559E-04	6.946E-07	9.724E-08	1.153E-03	1.392E-03	ND	ND	1.427E-03	1.187E-03	1.723E-06	5.446E-07
1,4-Dioxane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl Methacrylate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyclopentanone	ND	ND	ND	ND	ND	ND	ND	ND	4.337E-04	ND	3.109E-06	9.824E-07
Hexanal	5.627E-04	5.660E-04	1.516E-06	2.122E-07	5.630E-04	ND	7.595E-07	1.268E-06	7.876E-04	7.147E-04	5.221E-07	1.650E-07
2-Furaldehyde	1.833E-03	ND	1.216E-05	1.703E-06	7.089E-04	ND	9.563E-07	1.596E-06	3.859E-04	ND	2.766E-06	8.741E-07
Cyclohexanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptanal	7.039E-04	5.144E-04	1.619E-06	2.267E-07	6.895E-04	7.930E-04	ND	ND	6.667E-04	5.849E-04	5.861E-07	1.852E-07
2-Butoxyethanol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzaldehyde	2.120E-03	7.777E-04	9.329E-06	1.306E-06	1.947E-03	1.041E-03	1.222E-06	2.040E-06	1.651E-03	7.646E-04	6.353E-06	2.008E-06
6-Methyl-5-hepten-2-one	ND	ND	ND	ND	ND	2.114E-03	ND	ND	ND	9.693E-04	ND	ND
Octanal	1.230E-03	9.778E-04	1.688E-06	2.364E-07	1.011E-03	1.006E-03	6.838E-09	1.141E-08	1.515E-03	9.075E-04	4.356E-06	1.377E-06
Benzofuran	3.422E-04	ND	1.880E-06	2.633E-07	3.797E-04	ND	5.122E-07	8.549E-07	ND	ND	ND	ND
2-Ethyl-1-hexanol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-2. (Continued)

Compound (a)	Simulator Ground Burst				Green Star Cluster Signal Flare				Green Parachute Signal Flare			
	Average NEW, lb = 0.35				Average NEW, lb = 1.67				Average NEW, lb = 0.32			
	Average Number of Items = 2.5				Average Number of Items = 1				Average Number of Items = 1			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Acetophonone	2.998E-04	ND	2.102E-06	2.942E-07	4.260E-04	ND	5.747E-07	9.592E-07	3.137E-04	ND	2.249E-06	7.106E-07
Nonanal	1.523E-03	1.605E-03	2.494E-07	3.491E-08	1.139E-03	1.026E-03	1.531E-07	2.555E-07	2.434E-03	1.344E-03	7.819E-06	2.471E-06
Decanal	1.912E-03	1.352E-03	3.374E-06	4.724E-07	8.744E-04	8.777E-04	ND	ND	2.660E-03	1.007E-03	1.185E-05	3.745E-06
Carbonyl Sulfide	4.022E-04	1.881E-04	1.530E-06	2.142E-07	3.619E-04	3.282E-04	4.554E-08	7.601E-08	2.988E-04	1.869E-04	8.021E-07	2.535E-07
Carbon Disulfide	5.496E-02	4.533E-04	3.613E-04	5.059E-05	9.335E-03	1.684E-03	1.032E-05	1.723E-05	9.840E-03	5.277E-04	6.675E-05	2.109E-05
Thiophene	3.859E-04	ND	2.564E-06	3.590E-07	3.834E-04	ND	5.172E-07	8.632E-07	3.457E-04	ND	2.478E-06	7.831E-07
Dimethyldisulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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Items in bold represent duplicate values for those compounds that are common for Method TO-14 and TO-12.

Table B-2. (Continued)

Compound (a)	White Parachute Signal Flare, Average NEW, lb = 0.28, Average Number of Items = 1				155mm Illumination Round, Average NEW, lb = 6.12, Average Number of Items = 1			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Total Nonmethane Hydrocarbons (TNMHC)								
TNMHC	1.344E-01	9.740E-02	3.004E-04	8.493E-05	7.089E-01	3.620E-02	2.489E-04	1.524E-03
Volatile Organic Compounds (VOCs)								
Ethane	4.000E-03	3.100E-03	7.318E-06	2.069E-06	5.550E-03	2.500E-03	1.128E-06	6.909E-06
Ethylene	1.195E-02	2.800E-03	7.440E-05	2.103E-05	1.243E-01	2.000E-04	4.591E-05	2.811E-04
Acetylene	7.300E-03	4.500E-03	2.277E-05	6.436E-06	1.140E-01	7.000E-04	4.192E-05	2.567E-04
Propane	1.750E-03	1.500E-03	2.033E-06	5.746E-07	1.745E-02	8.000E-04	6.160E-06	3.772E-05
Propene	4.500E-03	1.300E-03	2.602E-05	7.355E-06	1.885E-02	ND	6.974E-06	4.270E-05
i-Butane	3.800E-03	3.400E-03	3.252E-06	9.194E-07	7.500E-04	1.000E-04	2.405E-07	1.472E-06
i-Butene	8.500E-04	5.000E-04	2.846E-06	8.045E-07	1.070E-02	ND	3.959E-06	2.424E-05
1-Butene	7.500E-04	2.000E-04	4.472E-06	1.264E-06	8.750E-03	ND	3.237E-06	1.982E-05
1,3-Butadiene	7.500E-04	2.000E-04	4.472E-06	1.264E-06	ND	ND	ND	ND
n-Butane	1.650E-03	1.800E-03	ND	ND	3.600E-03	4.000E-04	1.184E-06	7.249E-06
trans-2-Butene	1.150E-03	2.000E-04	7.724E-06	2.184E-06	3.700E-03	ND	1.369E-06	8.381E-06
2,2-Dimethylpropane	ND	ND	ND	ND	ND	ND	ND	ND
cis-2-Butene	2.000E-04	1.000E-04	8.131E-07	2.299E-07	1.550E-03	ND	5.734E-07	3.511E-06
3-Methyl-1-butene	1.000E-04	1.000E-04	0.000E+00	0.000E+00	4.000E-04	ND	1.480E-07	9.061E-07
i-Pentane	3.500E-03	3.800E-03	ND	ND	1.000E-03	5.000E-04	1.850E-07	1.133E-06
1-Pentene	2.000E-04	1.000E-04	8.131E-07	2.299E-07	3.500E-03	ND	1.295E-06	7.928E-06
2-Methyl-1-butene	2.500E-04	1.000E-04	1.220E-06	3.448E-07	1.400E-03	ND	5.179E-07	3.171E-06
n-Pentane	2.850E-03	3.200E-03	ND	ND	1.700E-03	6.000E-04	4.070E-07	2.492E-06
Isoprene	ND	1.000E-04	ND	ND	ND	2.000E-04	ND	ND
trans-2-Pentene	2.000E-04	1.000E-04	8.131E-07	2.299E-07	5.500E-04	ND	2.035E-07	1.246E-06
cis-2-Pentene	ND	1.000E-04	ND	ND	4.000E-04	ND	1.480E-07	9.061E-07
2-Methyl-2-butene	ND	2.000E-04	ND	ND	ND	ND	ND	ND
2,2-Dimethylbutane	4.000E-04	4.000E-04	0.000E+00	0.000E+00	ND	1.000E-04	ND	ND
Cyclopentene	ND	ND	ND	ND	1.800E-03	ND	6.659E-07	4.077E-06
4-Methyl-1-pentene	ND	ND	ND	ND	ND	ND	ND	ND
Cyclopentane	2.000E-04	3.000E-04	ND	ND	5.000E-04	1.000E-04	1.480E-07	9.061E-07
2,3-Dimethylbutane	1.050E-03	1.100E-03	ND	ND	4.000E-04	4.000E-04	ND	ND
cis-4-Methyl-2-pentene	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylpentane	2.800E-03	4.000E-03	ND	ND	1.300E-03	8.000E-04	1.850E-07	1.133E-06
3-Methylpentane	2.000E-04	2.000E-03	ND	ND	1.200E-03	7.000E-04	1.850E-07	1.133E-06
2-Methyl-1-pentene	ND	ND	ND	ND	ND	ND	ND	ND
1-Hexene	3.000E-04	ND	2.439E-06	6.896E-07	4.950E-03	ND	1.831E-06	1.121E-05
n-Hexane	2.800E-03	2.900E-03	ND	ND	1.950E-03	8.000E-04	4.254E-07	2.605E-06
trans-2-Hexene	ND	1.000E-04	ND	ND	ND	ND	ND	ND
2-Methyl-2-pentene	ND	1.000E-04	ND	ND	ND	ND	ND	ND
cis-2-Hexene	ND	1.000E-04	ND	ND	ND	ND	ND	ND
Methylcyclopentane	1.300E-03	1.200E-03	8.131E-07	2.299E-07	7.000E-04	4.000E-04	1.110E-07	6.796E-07
2,4-Dimethylpentane	2.000E-03	1.400E-03	4.878E-06	1.379E-06	1.150E-03	9.000E-04	9.249E-08	5.663E-07
Benzene	7.500E-03	3.400E-03	3.334E-05	9.424E-06	4.770E-02	1.100E-03	1.724E-05	1.056E-04
Cyclohexane	8.000E-04	1.000E-03	ND	ND	7.000E-04	2.000E-04	1.850E-07	1.133E-06

Table B-2. (Continued)

Compound (a)	White Parachute Signal Flare				155mm Illumination Round			
	Average NEW, lb = 0.28				Average NEW, lb = 6.12			
	Average Number of Items = 1				Average Number of Items = 1			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
2-Methylhexane	1.150E-03	1.100E-03	4.065E-07	1.149E-07	6.000E-04	4.000E-04	7.399E-08	4.530E-07
2,3-Dimethylpentane	3.800E-03	3.800E-03	0.000E+00	0.000E+00	2.100E-03	1.900E-03	7.399E-08	4.530E-07
3-Methylhexane	1.300E-03	1.400E-03	ND	ND	9.000E-04	4.000E-04	1.850E-07	1.133E-06
2,2,4-Trimethylpentane	7.350E-03	7.400E-03	ND	ND	5.500E-03	3.700E-03	6.659E-07	4.077E-06
n-Heptane	1.100E-03	1.100E-03	0.000E+00	0.000E+00	1.100E-03	3.000E-04	2.960E-07	1.812E-06
2,4,4-Trimethyl-1-pentene	ND	ND	ND	ND	ND	ND	ND	ND
Methylcyclohexane	7.000E-04	8.000E-04	ND	ND	1.100E-03	2.000E-04	3.330E-07	2.039E-06
2,4,4-Trimethyl-2-pentene	ND	ND	ND	ND	ND	ND	ND	ND
2,5-Dimethylhexane	5.000E-04	5.000E-04	0.000E+00	0.000E+00	4.500E-04	3.000E-04	5.549E-08	3.398E-07
2,4-Dimethylhexane	8.000E-04	8.000E-04	0.000E+00	0.000E+00	7.500E-04	4.000E-04	1.295E-07	7.928E-07
2,3,4-Trimethylpentane	1.600E-03	1.600E-03	0.000E+00	0.000E+00	1.050E-03	9.000E-04	5.549E-08	3.398E-07
Toluene	8.550E-03	7.800E-03	6.098E-06	1.724E-06	1.360E-02	3.000E-03	3.922E-06	2.401E-05
2,3-Dimethylhexane	6.000E-04	5.000E-04	8.131E-07	2.299E-07	2.000E-04	4.000E-04	ND	ND
2-Methylheptane	3.500E-04	3.000E-04	4.065E-07	1.149E-07	3.000E-04	1.000E-04	7.399E-08	4.530E-07
3-Ethylhexane	ND	ND	ND	ND	ND	ND	ND	ND
2,2-Dimethylheptane	ND	ND	ND	ND	ND	ND	ND	ND
2,2,4-Trimethylhexane	4.000E-04	4.000E-04	0.000E+00	0.000E+00	1.000E-03	2.000E-04	2.960E-07	1.812E-06
n-Octane	3.000E-04	3.000E-04	0.000E+00	0.000E+00	6.000E-04	1.000E-04	1.850E-07	1.133E-06
Ethylcyclohexane	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	1.050E-03	8.000E-04	2.033E-06	5.746E-07	2.100E-03	3.000E-04	6.659E-07	4.077E-06
m-Xylene & p-Xylene	3.950E-03	3.500E-03	3.659E-06	1.034E-06	3.300E-03	1.400E-03	7.029E-07	4.304E-06
Styrene	6.500E-04	5.000E-04	1.220E-06	3.448E-07	ND	ND	ND	ND
o-Xylene	1.350E-03	1.100E-03	2.033E-06	5.746E-07	2.450E-03	5.000E-04	7.214E-07	4.417E-06
n-Nonane	3.000E-04	1.000E-04	1.626E-06	4.597E-07	6.000E-04	ND	2.220E-07	1.359E-06
i-Propylbenzene	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	3.000E-04	2.000E-04	8.131E-07	2.299E-07	7.500E-04	2.000E-04	2.035E-07	1.246E-06
p-Ethyltoluene	8.500E-04	7.000E-04	1.220E-06	3.448E-07	3.400E-03	3.000E-04	1.147E-06	7.022E-06
m-Ethyltoluene	4.500E-04	3.000E-04	1.220E-06	3.448E-07	8.000E-04	2.000E-04	2.220E-07	1.359E-06
1,3,5-Trimethylbenzene	4.500E-04	4.000E-04	4.065E-07	1.149E-07	1.050E-03	2.000E-04	3.145E-07	1.925E-06
o-Ethyltoluene	4.000E-04	2.000E-04	1.626E-06	4.597E-07	7.000E-04	1.000E-04	2.220E-07	1.359E-06
1,2,4-Trimethylbenzene & sec-Butylbenzene	1.200E-03	1.000E-03	1.626E-06	4.597E-07	3.650E-03	4.000E-04	1.202E-06	7.362E-06
n-Decane	2.500E-04	1.000E-04	1.220E-06	3.448E-07	4.000E-04	ND	1.480E-07	9.061E-07
alpha-Pinene	ND	ND	ND	ND	ND	ND	ND	ND
beta-Pinene	ND	ND	ND	ND	ND	ND	ND	ND
delta 3-Carene	ND	ND	ND	ND	ND	ND	ND	ND
d-Limonene	ND	ND	ND	ND	ND	ND	ND	ND
MTBE	1.800E-03	1.800E-03	0.000E+00	0.000E+00	7.000E-04	7.000E-04	0.000E+00	0.000E+00
ETBE	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	1.815E-03	1.432E-03	3.113E-06	8.800E-07	1.579E-03	1.507E-03	2.638E-08	1.615E-07
Methylchloride	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethene	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Butadiene	7.628E-04	2.034E-04	4.549E-06	1.286E-06	ND	ND	ND	ND
Methylbromide	ND	ND	ND	ND	ND	ND	ND	ND

Table B-2. (Continued)

Compound (a)	White Parachute Signal Flare, Average NEW, lb = 0.28, Average Number of Items = 1				155mm Illumination Round, Average NEW, lb = 6.12, Average Number of Items = 1			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Ethylchloride	ND	ND	ND	ND	ND	ND	ND	ND
Trichloromonofluoromethane	2.580E-03	2.612E-03	ND	ND	2.526E-03	2.515E-03	4.275E-09	2.618E-08
Vinylidenechloride	ND	ND	ND	ND	ND	ND	ND	ND
Methylenechloride	3.336E-03	1.287E-03	1.666E-05	4.709E-06	7.081E-01	2.044E-03	2.612E-04	1.599E-03
Allylchloride	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	8.791E-04	8.801E-04	ND	ND	8.568E-04	8.583E-04	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
Methylchloroform	3.886E-04	3.547E-04	2.759E-07	7.800E-08	3.655E-04	3.777E-04	ND	ND
Benzene	7.628E-03	3.458E-03	3.391E-05	9.586E-06	4.852E-02	1.119E-03	1.754E-05	1.074E-04
Carbontetrachloride	8.334E-04	7.438E-04	7.284E-07	2.059E-07	8.473E-04	7.746E-04	2.692E-08	1.648E-07
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND
cis 1,3-Dichloro-1-propene	ND	ND	ND	ND	ND	ND	ND	ND
trans 1,3-Dichloro-1-propene	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	8.696E-03	7.934E-03	6.203E-06	1.753E-06	1.383E-02	3.051E-03	3.989E-06	2.442E-05
1,2-Dibromoethane	ND	ND	ND	ND	ND	ND	ND	ND
Perchloroethylene	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	1.612E-03	1.228E-03	3.121E-06	8.822E-07	3.224E-03	4.606E-04	1.022E-06	6.260E-06
m&p-Xylene	3.607E-03	3.585E-03	1.724E-07	4.873E-08	3.197E-03	1.321E-03	6.942E-07	4.250E-06
Styrene	2.194E-04	ND	1.784E-06	5.044E-07	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	1.373E-03	1.119E-03	2.068E-06	5.845E-07	2.492E-03	5.086E-04	7.338E-07	4.493E-06
p-Ethyltoluene	5.570E-04	5.604E-04	ND	ND	4.888E-04	ND	1.808E-07	1.107E-06
1,3,5-Trimethylbenzene	2.870E-04	2.845E-04	2.068E-08	5.847E-09	2.760E-04	ND	1.021E-07	6.252E-07
1,2,4-Trimethylbenzene	9.466E-04	9.399E-04	5.420E-08	1.532E-08	9.123E-04	4.522E-04	1.702E-07	1.042E-06
Benzylchloride	ND	ND	ND	ND	ND	ND	ND	ND
m-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
p-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
o-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND
Phenylacetylene	ND	ND	ND	ND	2.300E-03	ND	8.507E-07	5.209E-06
Indane	ND	ND	ND	ND	ND	ND	ND	ND
2,3-Dihydro-1-methyl-1H-indene	ND	ND	ND	ND	ND	ND	ND	ND
2,3-Dihydro-4-methyl-1H-indene	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	9.064E-04	4.279E-04	3.891E-06	1.100E-06	9.705E-03	3.067E-04	3.477E-06	2.129E-05
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
1-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
Cyanogen	ND	ND	ND	ND	ND	ND	ND	ND

Table B-2. (Continued)

Compound (a)	White Parachute Signal Flare, Average NEW, lb = 0.28, Average Number of Items = 1: Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	155mm Illumination Round, Average NEW, lb = 6.12, Average Number of Items = 1: Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Methylnitrite	4.281E-04	ND	3.481E-06	9.841E-07	4.934E-03	ND	1.825E-06	1.118E-05
Acetonitrile	7.547E-04	ND	6.136E-06	1.735E-06	1.137E-02	ND	4.208E-06	2.577E-05
Acrylonitrile	8.593E-04	ND	6.987E-06	1.975E-06	9.319E-03	ND	3.448E-06	2.111E-05
Nitromethane	8.485E-04	ND	6.899E-06	1.950E-06	5.091E-03	ND	1.884E-06	1.153E-05
Propanenitrile	ND	ND	ND	ND	2.143E-03	ND	7.928E-07	4.855E-06
2-Methylpropanenitrile	ND	ND	ND	ND	ND	ND	ND	ND
Pentanenitrile	ND	ND	ND	ND	2.369E-03	ND	8.764E-07	5.366E-06
Hexanenitrile	ND	ND	ND	ND	2.798E-03	ND	1.035E-06	6.338E-06
Benzonitrile	3.458E-04	ND	2.812E-06	7.948E-07	6.814E-03	ND	2.521E-06	1.544E-05
2-Nitrophenol	ND	ND	ND	ND	8.901E-04	ND	3.293E-07	2.016E-06
Acrolein	5.040E-04	ND	4.098E-06	1.158E-06	1.283E-02	ND	4.746E-06	2.906E-05
Acetone	1.063E-02	8.348E-03	1.857E-05	5.251E-06	6.430E-02	7.235E-03	2.111E-05	1.293E-04
1-Hydroxy-2-propanone	ND	ND	ND	ND	ND	ND	ND	ND
Furan	1.599E-04	ND	1.300E-06	3.676E-07	2.073E-03	ND	7.671E-07	4.697E-06
2-Propanol	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylpropanal	ND	ND	ND	ND	2.207E-03	ND	8.165E-07	4.999E-06
1-Propanol	ND	ND	ND	ND	ND	ND	ND	ND
Methacrolein	ND	ND	ND	ND	2.238E-03	ND	8.281E-07	5.070E-06
Methyl-vinyl Ketone	ND	ND	ND	ND	1.426E-03	ND	5.275E-07	3.230E-06
MTBE	1.734E-03	1.677E-03	4.656E-07	1.316E-07	6.468E-04	5.544E-04	3.419E-08	2.093E-07
2,3-Butanedione	ND	ND	ND	ND	ND	ND	ND	ND
Butanal	ND	3.764E-04	ND	ND	1.530E-03	ND	5.660E-07	3.465E-06
2-Butanone	1.882E-03	1.053E-03	6.736E-06	1.904E-06	7.749E-03	7.941E-04	2.573E-06	1.576E-05
2-Methyl-1,3-dioxolane	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylfuran	ND	ND	ND	ND	ND	ND	ND	ND
Tetrahydrofuran	ND	ND	ND	ND	2.440E-04	ND	9.028E-08	5.528E-07
trans-2-Butenal	1.821E-04	ND	1.480E-06	4.185E-07	1.474E-03	ND	5.454E-07	3.340E-06
Acetic Acid	1.453E-03	1.211E-03	1.961E-06	5.544E-07	5.240E-03	1.105E-03	1.530E-06	9.366E-06
1-Butanol	ND	ND	ND	ND	ND	ND	ND	ND
2-Pentanone	5.631E-04	ND	4.579E-06	1.294E-06	1.577E-03	ND	5.836E-07	3.573E-06
Pentanal	8.153E-04	1.785E-03	ND	ND	4.933E-03	1.610E-03	1.229E-06	7.526E-06
1,4-Dioxane	ND	ND	ND	ND	ND	ND	ND	ND
Methyl Methacrylate	ND	ND	ND	ND	ND	ND	ND	ND
Cyclopentanone	ND	ND	ND	ND	7.454E-02	ND	2.758E-05	1.688E-04
Hexanal	9.454E-04	1.397E-03	ND	ND	1.607E-03	1.206E-03	1.483E-07	9.080E-07
2-Furaldehyde	2.995E-04	ND	2.435E-06	6.883E-07	1.348E-02	ND	4.987E-06	3.053E-05
Cyclohexanone	ND	ND	ND	ND	ND	ND	ND	ND
Heptanal	7.979E-04	7.488E-04	3.987E-07	1.127E-07	1.567E-03	9.731E-04	2.197E-07	1.345E-06
2-Butoxyethanol	ND	ND	ND	ND	ND	ND	ND	ND
Benzaldehyde	1.870E-03	8.702E-04	8.133E-06	2.299E-06	8.789E-03	6.469E-04	3.012E-06	1.844E-05
6-Methyl-5-hepten-2-one	ND	9.276E-04	ND	ND	ND	4.461E-04	ND	ND
Octanal	1.915E-03	1.799E-03	9.485E-07	2.681E-07	1.990E-03	1.464E-03	1.948E-07	1.193E-06
Benzofuran	ND	ND	ND	ND	ND	ND	ND	ND
2-Ethyl-1-hexanol	ND	ND	ND	ND	ND	ND	ND	ND

Table B-2. (Continued)

Compound (a)	White Parachute Signal Flare, Average NEW, lb = 0.28, Average Number of Items = 1: Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	155mm Illumination Round, Average NEW, lb = 6.12, Average Number of Items = 1: Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Acetophonone	3.121E-04	ND	2.538E-06	7.174E-07	1.797E-03	ND	6.648E-07	4.071E-06
Nonanal	2.796E-03	2.754E-03	3.415E-07	9.655E-08	2.728E-03	2.037E-03	2.553E-07	1.563E-06
Decanal	1.863E-03	1.907E-03	ND	ND	3.168E-03	2.172E-03	3.686E-07	2.257E-06
Carbonyl Sulfide	2.983E-04	1.934E-04	8.526E-07	2.410E-07	1.697E-03	1.588E-04	5.690E-07	3.484E-06
Carbon Disulfide	9.263E-03	5.646E-04	7.073E-05	1.999E-05	2.962E-02	1.418E-03	1.043E-05	6.388E-05
Thiophene	2.820E-04	ND	2.293E-06	6.483E-07	1.321E-03	ND	4.886E-07	2.991E-06
Dimethyldisulfide	ND	ND	ND	ND	ND	ND	ND	ND

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Items in bold represent duplicate values for those compounds that are common for Method TO-14 and TO-12.

Table B-3. AEC Training Ordnance Emission Factors for SVOC

Compound	Simulator Booby Trap Flash M117				Simulator Flash Artillery M110				Simulator Hand Grenade			
	Average NEW, lb = 0.22				Average NEW, lb = 0.19				Average NEW, lb = 0.32			
	Average Number of Items = 29				Average Number of Items = 1				Average Number of Items = 4			
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Particulate/Vapor-phase SVOCs												
N-Nitrosodimethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyridine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Picoline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl methanesulfonate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosomethylethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl methanesulfonate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzyl alcohol	ND	ND	ND	ND	5.153E-04	ND	7.259E-06	1.361E-06	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Toluidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol/3-Methylphenol	ND	ND	ND	ND	4.751E-04	ND	6.608E-06	1.239E-06	ND	ND	ND	ND
N-Nitroso-di-n-propylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone	3.623E-04	2.808E-04	9.977E-07	7.682E-09	ND	1.786E-04	ND	ND	6.209E-04	1.897E-04	3.376E-06	2.735E-07
N-Nitrosomorpholine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopyrrolidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopiperidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethoxy)methane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzoic acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	3.006E-04	ND	3.678E-06	2.832E-08	2.487E-02	ND	3.473E-04	6.512E-05	6.122E-04	ND	4.789E-06	3.879E-07
p-Chloroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethylphenethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitroso-di-n-butylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloro-3-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Safrole	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-3. (Continued)

Compound	Simulator Booby Trap Flash M117 Average NEW, lb = 0.22 Average Number of Items = 29				Simulator Flash Artillery M110 Average NEW, lb = 0.19 Average Number of Items = 1				Simulator Hand Grenade Average NEW, lb = 0.32 Average Number of Items = 4			
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
2-Methylnaphthalene	ND	ND	ND	ND	1.074E-02	ND	1.495E-04	2.804E-05	2.530E-04	ND	1.990E-06	1.612E-07
1,2,4,5-Tetrachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isosafrole	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Naphthoquinone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	5.057E-04	ND	7.152E-06	1.341E-06	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Naphthylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Naphthylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethylphthalate	2.532E-04	4.340E-04	ND	ND	9.944E-05	2.247E-04	ND	ND	2.007E-04	ND	1.578E-06	1.278E-07
4-Chlorophenylphenyl ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	1.009E-04	ND	1.405E-06	2.635E-07	ND	ND	ND	ND
5-Nitro-o-toluidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diphenylamine/N-NitrosoDPA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sym-Trinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diallate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenacetin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Bromophenylphenyl ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Aminobiphenyl	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pronamide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloronitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	2.954E-04	ND	4.172E-06	7.823E-07	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butylphthalate	1.436E-03	7.766E-04	8.070E-06	6.214E-08	7.337E-04	1.615E-03	ND	ND	3.892E-03	ND	3.017E-05	2.444E-06
4-Nitroquinoline-1-oxide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-3. (Continued)

Compound	Simulator Booby Trap Flash M117				Simulator Flash Artillery M110				Simulator Hand Grenade			
	Average NEW, lb = 0.22				Average NEW, lb = 0.19				Average NEW, lb = 0.32			
	Average Number of Items = 29				Average Number of Items = 1				Average Number of Items = 4			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Methapyrilene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Dimethylaminoazobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzilate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Kepone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butylbenzylphthalate	3.242E-04	ND	3.967E-06	3.055E-08	ND	ND	ND	ND	1.489E-03	ND	1.163E-05	9.417E-07
3,3'-Dimethylbenzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Acetylaminofluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND	9.531E-04	2.139E-02	ND	ND
3,3'-Dichlorobenzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benz(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7,12-Dimethylbenz(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benz(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylcholanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-3. (Continued)

Compound	Simulator Ground Burst Average NEW, lb = 0.35 Average Number of Items = 2.5				Green Star Cluster Signal Flare Average NEW, lb = 1.67 Average Number of Items = 1				Green Parachute Signal Flare Average NEW, lb = 0.32 Average Number of Items = 1			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Particulate/Vapor-phase SVOCs												
N-Nitrosodimethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyridine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Picoline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl methanesulfonate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosomethylethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl methanesulfonate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzyl alcohol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Toluidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol/3-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitroso-di-n-propylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone	6.804E-04	1.897E-04	4.219E-06	5.907E-07	5.830E-04	2.708E-04	4.578E-07	7.641E-07	4.185E-04	2.708E-04	1.164E-06	3.679E-07
N-Nitrosomorpholine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopyrrolidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopiperidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethoxy)methane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzoic acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	1.146E-03	ND	9.871E-06	1.382E-06	6.994E-04	2.995E-04	5.863E-07	9.786E-07	6.085E-04	2.995E-04	2.435E-06	7.694E-07
p-Chloroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethylphenethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitroso-di-n-butylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloro-3-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Safrole	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-3. (Continued)

Compound	Simulator Ground Burst Average NEW, lb = 0.35 Average Number of Items = 2.5				Green Star Cluster Signal Flare Average NEW, lb = 1.67 Average Number of Items = 1				Green Parachute Signal Flare Average NEW, lb = 0.32 Average Number of Items = 1			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
2-Methylnaphthalene	3.538E-04	ND	2.957E-06	4.140E-07	2.725E-04	ND	3.996E-07	6.669E-07	2.645E-04	ND	2.085E-06	6.588E-07
1,2,4,5-Tetrachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isosafrole	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Naphthoquinone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Naphthylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Naphthylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethylphthalate	2.278E-04	ND	1.904E-06	2.665E-07	8.956E-04	3.475E-04	8.038E-07	1.342E-06	2.019E-03	3.475E-04	1.318E-05	4.164E-06
4-Chlorophenylphenyl ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5-Nitro-o-toluidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diphenylamine/N-NitrosoDPA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sym-Trinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diallate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenacetin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Bromophenylphenyl ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Aminobiphenyl	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pronamide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloronitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butylphthalate	2.408E-03	ND	2.089E-05	2.925E-06	1.302E-03	1.357E-03	ND	ND	9.726E-04	1.357E-03	ND	ND
4-Nitroquinoline-1-oxide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-3. (Continued)

Compound	Simulator Ground Burst				Green Star Cluster Signal Flare				Green Parachute Signal Flare			
	Average NEW, lb = 0.35				Average NEW, lb = 1.67				Average NEW, lb = 0.32			
	Average Number of Items = 2.5				Average Number of Items = 1				Average Number of Items = 1			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Methapyrilene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Dimethylaminoazobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzilate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Kepone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butylbenzylphthalate	1.781E-03	ND	1.542E-05	2.158E-06	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dimethylbenzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Acetylaminofluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	2.335E-03	2.139E-02	ND	ND	6.725E-03	ND	9.860E-06	1.646E-05	ND	ND	ND	ND
3,3'-Dichlorobenzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benz(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	6.137E-04	ND	5.315E-06	7.441E-07	ND	ND	ND	ND	ND	ND	ND	ND
7,12-Dimethylbenz(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benz(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylcholanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-3. (Continued)

Compound	White Parachute Signal Flare				155mm Illumination Round			
	Average NEW, lb = 0.28				Average NEW, lb = 6.12			
	Average Number of Items = 1				Average Number of Items = 1			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Particulate/Vapor-phase SVOCs								
N-Nitrosodimethylamine	ND	ND	ND	ND	ND	ND	ND	ND
Pyridine	ND	ND	ND	ND	ND	ND	ND	ND
2-Picoline	ND	ND	ND	ND	ND	ND	ND	ND
Methyl methanesulfonate	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosomethylethylamine	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiethylamine	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl methanesulfonate	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	ND	ND	ND	ND	ND	ND	ND	ND
Aniline	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethyl)ether	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloroethane	ND	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Benzyl alcohol	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	ND
o-Toluidine	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol/3-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitroso-di-n-propylamine	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone	5.510E-04	2.708E-04	2.532E-06	7.159E-07	2.883E-03	2.071E-04	9.861E-07	6.038E-06
N-Nitrosomorpholine	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopyrrolidine	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopiperidine	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethoxy)methane	ND	ND	ND	ND	ND	ND	ND	ND
Benzoic acid	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	4.426E-04	2.995E-04	1.293E-06	3.655E-07	5.579E-03	ND	2.056E-06	1.259E-05
p-Chloroaniline	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloropropene	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND
Dimethylphenethylamine	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitroso-di-n-butylamine	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloro-3-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
Safrole	ND	ND	ND	ND	ND	ND	ND	ND

Table B-3. (Continued)

	White Parachute Signal Flare				155mm Illumination Round			
	Average NEW, lb = 0.28				Average NEW, lb = 6.12			
	Average Number of Items = 1				Average Number of Items = 1			
Compound	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND
Isosafrole	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Naphthoquinone	ND	ND	ND	ND	ND	ND	ND	ND
Dimethylphthalate	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1-Naphthylamine	ND	ND	ND	ND	ND	ND	ND	ND
2-Naphthylamine	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND
Diethylphthalate	5.907E-04	3.475E-04	2.199E-06	6.216E-07	1.776E-03	1.381E-04	6.038E-07	3.697E-06
4-Chlorophenylphenyl ether	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND
5-Nitro-o-toluidine	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
Diphenylamine/N-NitrosoDPA	ND	ND	ND	ND	ND	ND	ND	ND
sym-Trinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Diallate	ND	ND	ND	ND	ND	ND	ND	ND
Phenacetin	ND	ND	ND	ND	ND	ND	ND	ND
4-Bromophenylphenyl ether	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
4-Aminobiphenyl	ND	ND	ND	ND	ND	ND	ND	ND
Pronamide	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloronitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butylphthalate	3.134E-03	1.357E-03	1.606E-05	4.541E-06	4.077E-03	7.691E-04	1.219E-06	7.465E-06
4-Nitroquinoline-1-oxide	ND	ND	ND	ND	ND	ND	ND	ND

Table B-3. (Continued)

Compound	White Parachute Signal Flare, Average NEW, lb = 0.28, Average Number of Items = 1				155mm Illumination Round, Average NEW, lb = 6.12, Average Number of Items = 1			
	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)	Measured Actual Concentration (mg/m^3)	Measured Background Concentration (mg/m^3)	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/item)
Methapyrilene	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benzidine	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND
p-Dimethylaminoazobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzilate	ND	ND	ND	ND	ND	ND	ND	ND
Kepone	ND	ND	ND	ND	ND	ND	ND	ND
Butylbenzylphthalate	ND	ND	ND	ND	3.028E-03	ND	1.116E-06	6.833E-06
3,3'-Dimethylbenzidine	ND	ND	ND	ND	ND	ND	ND	ND
2-Acetylaminofluorene	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	ND	ND	ND	ND	ND	ND	ND	ND
Benz(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	ND	ND	ND	ND	ND	ND	ND	ND
7,12-Dimethylbenz(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benz(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylcholanthrene	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	ND

APPENDIX I-C. SAMPLE CALCULATIONS

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CALCULATION SHEET

Calc. No. 1

Signature William L. McCarter Date 02/01/99 Checked John Carson Date 02/02/99
Project AEC Phase I Emissions Characterization Job No. 655257.05
Subject AEC Munition Item Data Sheet for Sample Calculations

Munition Item: Booby Trap Flash (all other munition items are calculated similarly)
No. of Runs: 1 [multiple runs (i.e., more than one run) are averaged to calculate the final emission factor]
No. of Items: 29

EMISSION FACTOR CALCULATION INPUT DATA

Input Data Given (Appendix II-A, Tables A-1 and A-2):

Sample Volumes are calculated based on the average sample flow rate measured by sample flow meters used as part of the sampling system. Flowrates are measured in actual ft^3/min. The total sample volume is then calculated as ft^3/min x sample time (min) and recorded as standard ft^3 (at 20 °C, 760 mmHg).

Sample Volumes (ft^3):	Train A	Train B	Avg.	Bkgd.
TSP	708.85	851.28	780.07	1497.2
PM_{10}	310.41	199.9	255.16	987.9
Metals	708.85	851.28	780.07	1497.2
VOCs	NA	NA	NA	NA
SVOCs	83.82	73.19	78.51	119.6
HCl/Cl_2	25.58	26.73	26.16	28.16
Dioxin/Furan	100.47	81.98	91.23	150.2

Sample Weight Gain is the net weight change between the initial and final particulate weights. Each filter is preweighed for a "tare" weight and the filter is reweighed after drying to determine the net particulate gain.

Sample Weight Gain (g):	Train A	Train B	Avg.	Bkgd.
TSP	0.6549	0.6869	0.6709	0.0035
PM_{10}	0.3199	0.3557	0.3378	0.0032

Dilution Correction Factors (Appendix II-A and II-B):

To determine the percent plume sampled for concentration correction factor.

Decay Equation For Booby Trap Flash Run: $y = 353.43e^{-0.0156x}$

C = 353.43 Initial Tracer Concentration (y-intercept)
a = -0.0156 (slope of regression line)
Start Time (min) [A] = 0
Stop Time (min) [B] = 25
Sample Duration (min) [D] = 25

1. The methodology consists of determining the average tracer concentration by integrating the decay equation over the sample duration.
2. The methodology calculates the average tracer concentration for the appropriate sample duration.
3. Knowing the initial concentration and the average concentration, the percent plumed sampled is then calculated from that ratio:

Average tracer concentration = $C / a\, [\, (e^{A*a} - e^{B*a}) / D\,]$

= $\boxed{293}$

Dilution Factor (Percent Plume Sampled) = Average tracer concentration / C * 100

= $\boxed{82.81}$ Note: the VOC dilution factor is determined for each VOC cannister.

See OGI VOC data for plume volume
Initial Plume Volume (m^3) in BangBox:

1026.43 m^3
$\boxed{36248}$ ft^3

Known (total for all items)
Net Explosive Weight (g):

101.29 g
$\boxed{0.22}$ lb

Dilution Correction Factors	Run No. 1
TSP	0.8281
PM_{10}	0.9259
Metals	0.8281
VOCs	0.9153
SVOCs	0.8281
HCl/Cl_2	0.8281
Dioxin/Furan	0.8281
CEM	0.8281

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CALCULATION SHEET

Calc. No. 1

Signature William L. McCarter Date 02/01/99 Checked John Carson Date 02/02/99
Project AEC Phase I Emissions Characterization Job No. 655257.05
Subject AEC Munition Item TSP/PM_{10} Data Sheet for Sample Calculations

EMISSION FACTOR CALCULATION OF TSP/PM_{10} DATA

Input Data Given (Appendix II-A, Tables A-1 and A-2 and Appendix II-C, Tables C-1 and C-2):

Sample Volumes (ft^3):	Train A	Train B	Avg.	Bkgd.
TSP	708.85	851.28	780.07	1497.2
PM_{10}	310.41	199.9	255.16	987.9
Sample Weight Gain (g):	Train A	Train B	Avg.	Bkgd.
TSP	0.6549	0.6869	0.6709	0.0035
PM_{10}	0.3199	0.3557	0.3378	0.0032

Average and Background Concentrations (Appendix II-A, Tables A-3 and A-4, Appendix II-C, Tables C-1 and C-2):

$$\text{TSP Train A Concentration (mg/m}^3\text{)} = \frac{[\text{Weight Gain (g)} \times (1\ \text{mg} / 10^{-3}\ \text{g})]}{[\text{Train A Sample Volume (ft}^3\text{)} \times 1\ \text{m}^3 / 35.3145\ \text{ft}^3]}$$

$$\text{TSP Train A Concentration (mg/m}^3\text{)} = \frac{654.9\ \text{mg}}{20.1\ \text{m}^3} = 3.26\text{E+01 mg/m}^3$$

$$\text{TSP Train B Concentration (mg/m}^3\text{)} = \frac{686.9\ \text{mg}}{24.1\ \text{m}^3} = 2.85\text{E+01 mg/m}^3$$

Average Concentration (mg/m^3) = $\boxed{3.06\text{E+01 mg/m}^3}$

Background Concentration (mg/m^3) = $\boxed{8.26\text{E-02 mg/m}^3}$

These are the calculated sample concentrations for the TSP data. The PM_{10} data is calculated similarly.

Corrected Concentrations (Appendix II-A, Table A-4):

Average Concentration (mg/m^3) = 3.06E+01 -
Background Concentration (mg/m^3) = 8.26E-02
Background Corrected Concentration [BCC] (mg/m^3) = $\boxed{3.05\text{E+01}}$

Subtraction of background concentration from the average concentration

Dilution Correction Factor [DCF] = 0.8281
Corrected Concentration [CC] (mg/m^3) = $\boxed{3.68\text{E+01}}$ = BCC / DCF
Initial Plume Volume (ft^3) = 36248

Sample Total Material (lb) in BangBox = $\boxed{8.33\text{E-02}}$ = [CC x (10^{-3} g / mg) x (2.20462 lb / 1000 g)] x [Initial Plume Volume (ft^3) x (1 m^3 / 35.3145 ft^3)]

Number of Items = 29
Net Explosive Weight (lb) = 0.22

TSP Corrected Emission Factor (lb/item) =	2.87E-03
TSP Corrected Emission Factor (lb/lb NEW) =	3.73E-01

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CALCULATION SHEET

Calc. No. 1

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Project AEC Phase I Emissions Characterization Job No. 655257.05
Subject AEC Munition Item Metals Data Sheet for Sample Calculations

EMISSION FACTOR CALCULATION OF METALS DATA

Input Data Given (Appendix II-A, Tables A-1 and A-2):

Metal concentrations are determined from digestion and analysis of the TSP.

Sample Volumes (ft^3):	Train A	Train B	Avg.	Bkgd.
TSP	708.85	851.28	780.07	1497.2
Metals	708.85	851.28	780.07	1497.2
Sample Weight Gain (g):	Train A	Train B	Avg.	Bkgd.
TSP	0.6549	0.6869	0.6709	0.0035

Average and Background Concentrations (Appendix II-A, Tables A-3 and A-4, Appendix II-D, Tables D-1 to D-3):

$$\text{Phosphorus Train A Concentration (mg/m}^3\text{)} = \frac{[\text{Amount Detected (mg/kg)} \times \text{Weight Gain (g)} \times (1\text{ kg} / 1000\text{ g})]}{[\text{Train A Sample Volume (ft}^3\text{)} \times 1\text{ m}^3 / 35.3145\text{ ft}^3]}$$

$$\text{Phosphorus Train A Concentration (mg/m}^3\text{)} = \frac{4.78\text{ mg}}{20.1\text{ m}^3} = 2.38\text{E-01 mg/m}^3$$

The phosphorus concentration is from analytical data.

$$\text{Phosphorus Train B Concentration (mg/m}^3\text{)} = \frac{5.17\text{ mg}}{24.1\text{ m}^3} = 2.15\text{E-01 mg/m}^3$$

Average Concentration (mg/m^3) = $\boxed{2.26\text{E-01 mg/m}^3}$

These are the calculated sample concentrations are for the Phosphorus data. The other metals data is calculated similarly.

Corrected Concentrations (Appendix II-A, Table A-4):

Average Concentration (mg/m^3) = 2.26E-01 -
Background Concentration (mg/m^3) = NA — Insufficient material to analyze
Background Corrected Concentration [BCC] (mg/m^3) = $\boxed{2.26\text{E-01}}$ — Subtraction of background concentration from the average concentration

Dilution Correction Factor [DCF] = 0.8281
Corrected Concentration [CC] (mg/m^3) = $\boxed{2.73\text{E-01}}$ — = BCC / DCF
Initial Plume Volume (ft^3) = 36248

Sample Total Material (lb) in BangBox = $\boxed{6.19\text{E-04}}$ — $= [CC \times (10^{-3}\text{ g / mg}) \times (2.20462\text{ lb / 1000 g})] \times [\text{Initial Plume Volume (ft}^3\text{)} \times (1\text{ m}^3 / 35.3145\text{ ft}^3)]$

Number of Items = 29
Net Explosive Weight (lb) = 0.22

P Corrected Emission Factor (lb/item) =	2.13E-05
P Corrected Emission Factor (lb/lb NEW) =	2.77E-03

CALCULATION SHEET

Calc. No. 1

Signature William L. McCarter Date 02/01/99 Checked John Carson Date 02/02/99
Project AEC Phase I Emissions Characterization Job No. 655257.05
Subject AEC Munition Item VOC Data Sheet for Sample Calculations

EMISSION FACTOR CALCULATION OF VOC DATA

Input Data Given (Appendix II-E, Tables E-1 to E-4):

Analytical data received from the OGI Laboratory comes in units of ug/m^3 or ppbv. The data in Appendix II-E are shown and tabulated separately.

Concentration Data (OGI)	Sample 1	Sample 2	Avg.		
Benzene (ug/m^3)	4.7	4.8	4.75	4.75E-03	mg/m^3
Carbon Disulfide (ppbv)	10.8	11.1	10.95	3.46E-02	mg/m^3

Average and Background Concentrations (Appendix II-A, Tables A-5 and A-6, Appendix II-E, Tables E-1 to E-4):

To express at standard conditions:

p =	1.0133E+05 Pa	pV = n R T ; n = m / MW
R =	8.314 m^3 Pa/gmol K	m = mass (grams)
T =	293.15 K	V = volume (m^3)
Molecular Weight (MW) =	76 g/gmol (carbon disulfide)	pV = m R T / MW
m / V (g/m^3) =	4.16E-05 x MW x ppmv	**m / V = p MW / R T**
m / V (mg/m^3) =	0.0416 x MW x ppmv	ppm = ppb / 1000
ppbv =	(mg/m^3 / 0.0416 / MW) x 1000	mg/m^3 = ug/m^3 / 1000
mg/m^3 =	(ppbv x 0.0416 x MW) / 1000	

Average Carbon Disulfide Concentration (mg/m^3) = 0.0416 x 76 x 10.95 / 1000

Average Carbon Disulfide Concentration (mg/m^3) = 0.035 mg/m^3

These are the calculated sample concentrations at standard conditions. Emission factor calc's for all VOCs after conversion to mg/m^3 are similar.

Benzene shown below is used as an example.

Average Concentration (mg/m^3) = 4.75E-03 mg/m^3 BENZENE

Background Concentration (mg/m^3) = 7.00E-04 mg/m^3

These are the calculated sample concentrations for the benzene data. The other VOC data is calculated similarly.

Corrected Concentrations (Appendix II-A, Table A-6):

Average Concentration (mg/m^3) = 4.75E-03 - BENZENE
Background Concentration (mg/m^3) = 7.00E-04
Background Corrected Concentration [BCC] (mg/m^3) = 4.05E-03

Subtraction of background concentration from the average concentration

Dilution Correction Factor [DCF] = 0.9153
Corrected Concentration [CC] (mg/m^3) = 4.42E-03 = BCC / DCF
Initial Plume Volume (ft^3) = 36248

Sample Total Material (lb) in BangBox = 1.00E-05 = [CC x (10^{-3} g / mg) x (2.20462 lb / 1000 g)] x [Initial Plume Volume (ft^3) x (1 m^3 / 35.3145 ft^3)]

Number of Items = 29
Net Explosive Weight (lb) = 0.22

Benzene Corrected Emission Factor (lb/item) = 3.45E-07
Benzene Corrected Emission Factor (lb/lb NEW) = 4.48E-05

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CALCULATION SHEET

Calc. No. 1

Signature William L. McCarter Date 02/01/99 Checked John Carson Date 02/02/99
Project AEC Phase I Emissions Characterization Job No. 655257.05
Subject AEC Munition Item SVOC Data Sheet for Sample Calculations

EMISSION FACTOR CALCULATION OF SVOC DATA

Input Data Given (Appendix II-A, Tables A-1 and A-2 and Appendix II-F, Tables F-1 to F-3):

*For one sample that is found as nondetect (ND), the reported value is used as an average.

Concentration and Volume	Train A	Train B	Avg.	Bkgd.
Acetophenone (ug)	0.86	ND*	0.86	0.95
SVOCs (ft^3)	83.82	73.19	78.51	119.6

Average and Background Concentrations (Appendix II-A, Tables A-7 and A-8, Appendix II-F, Tables F-1 to F-3):

$$\text{SVOC Train A Concentration (mg/m}^3\text{)} = \frac{[\text{Sample Concentration (ug)} / 1000]}{[\text{Train A Sample Volume (ft}^3\text{)} \times 1\ m^3 / 35.3145\ ft^3]}$$

$$\text{SVOC Train A Concentration (mg/m}^3\text{)} = \frac{0.00086\ \text{mg}}{2.4\ m^3} = 3.62\text{E-04 mg/m}^3$$

To express at standard conditions:

p =	1.0133E+05 Pa	pV = n R T ; n = m / MW
R =	8.314 m^3 Pa/gmol K	m = mass (grams)
T =	293.15 K	V = volume (m^3)
Molecular Weight (MW) =	120 g/gmol (acetophenone)	pV = m R T / MW
m / V (g/m^3) =	4.16E-05 x MW x ppmv	**m / V = p MW / R T**
m / V (mg/m^3) =	0.0416 x MW x ppmv	ppm = ppb / 1000
ppbv =	(mg/m^3 / 0.0416 / MW) x 1000	mg/m^3 = ug/m^3 / 1000

Average Concentration (ppbv) = 0.073 ppbv — These are the calculated sample concentrations corrected for standard conditions

Average Concentration (mg/m^3) = 3.62E-04 mg/m^3 — ACETOPHENONE

Background Concentration (mg/m^3) = 2.81E-04 mg/m^3 — These are the calculated sample concentrations for the acetophenone data. The other SVOC data is calculated similarly.

Corrected Concentrations (Appendix II-A, Table A-8):

Average Concentration (mg/m^3) = 3.62E-04 -
Background Concentration (mg/m^3) = 2.81E-04
Background Corrected Concentration [BCC] (mg/m^3) = 8.15E-05 — Subtraction of background concentration from the average concentration

Dilution Correction Factor [DCF] = 0.8281
Corrected Concentration [CC] (mg/m^3) = 9.84E-05 — = BCC / DCF
Initial Plume Volume (ft^3) = 36248

Sample Total Material (lb) in BangBox = 2.23E-07 — = [CC x (10^{-3} g / mg) x (2.20462 lb / 1000 g)] x [Initial Plume Volume (ft^3) x (1 m^3 / 35.3145 ft^3)]

Number of Items = 29
Net Explosive Weight (lb) = 0.22

Acetophenone Corrected Emission Factor (lb/item) = 7.68E-09
Acetophenone Corrected Emission Factor (lb/lb NEW) = 9.98E-07

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CALCULATION SHEET

Calc. No. 1

Signature William L. McCarter Date 02/01/99 Checked John Carson Date 02/02/99
Project AEC Phase I Emissions Characterization Job No. 655257.05
Subject AEC Munition Item HCl/Cl_2 Data Sheet for Sample Calculations

EMISSION FACTOR CALCULATION OF HCl/Cl_2 DATA

Input Data Given (Appendix II-A, Tables A-1 and A-2 and Appendix II-G, Tables G-1 to G-3):

Concentration data determined via Method 26 impinger train with H_2SO_4 and NaOH, which allows the determination of HCl and Cl_2, respectively.

Concentration and Volume	Train A	Train B	Avg.	Bkgd.
NaOH Impinger (ug) for Cl_2	11.8	50.75	31.28	2.00
HCl/Cl_2 (ft^3)	25.58	26.73	26.16	28.16

Note: all chlorine values were found to be near the detection limits and at the blank levels.

Average and Background Concentrations (Appendix II-A, Tables A-3 and A-4, Appendix II-G, Tables G-1 to G-3):

$$Cl_2 \text{ Train A Concentration } (mg/m^3) = \frac{[\text{Sample Concentration (ug) / 1000}]}{[\text{Train A Sample Volume } (ft^3) \times 1\ m^3 / 35.3145\ ft^3]}$$

$$Cl_2 \text{ Train A Concentration } (mg/m^3) = \frac{0.0118\ mg}{0.7\ m^3} = 1.63E\text{-}02\ mg/m^3$$

$$Cl_2 \text{ Train B Concentration } (mg/m^3) = \frac{0.05075\ mg}{0.8\ m^3} = 6.70E\text{-}02\ mg/m^3$$

To express at standard conditions:

p =	1.0133E+05 Pa	pV = n R T ; n = m / MW
R =	8.314 m^3 Pa/gmol K	m = mass (grams)
T =	293.15 K	V = volume (m^3)
Molecular Weight (MW) =	70.9 g/gmol (Cl_2)	pV = m R T / MW
m / V (g/m^3) =	4.16E-05 x MW x ppmv	**m / V = p MW / R T**
m / V (mg/m^3) =	0.0416 x MW x ppmv	ppm = ppb / 1000
ppbv =	(mg/m^3 / 0.0416 / MW) x 1000	mg/m^3 = ug/m^3 / 1000

Average Concentration (ppbv) = $\boxed{14.128\ ppbv}$ These are the calculated sample concentrations corrected for standard conditions

Average Concentration (mg/m^3) = $\boxed{4.17E\text{-}02\ mg/m^3}$

Background Concentration (mg/m^3) = $\boxed{2.51E\text{-}03\ mg/m^3}$ These are the calculated sample concentrations for the Cl_2 data. The other HCl/Cl_2 data is calculated similarly.

Corrected Concentrations (Appendix II-A, Table A-4):

Average Concentration (mg/m^3) = 4.17E-02 -
Background Concentration (mg/m^3) = 2.51E-03
Background Corrected Concentration [BCC] (mg/m^3) = $\boxed{3.92E\text{-}02}$ Subtraction of background concentration from the average concentration

Dilution Correction Factor [DCF] = 0.8281
Corrected Concentration [CC] (mg/m^3) = $\boxed{4.73E\text{-}02}$ = BCC / DCF
Initial Plume Volume (ft^3) = 36248

Sample Total Material (lb) in BangBox = $\boxed{1.07E\text{-}04}$ = [CC x (10^{-3} g / mg) x (2.20462 lb / 1000 g)] x [Initial Plume Volume (ft^3) x (1 m^3 / 35.3145 ft^3)]

Number of Items = 29
Net Explosive Weight (lb) = 0.22

Cl_2 Corrected Emission Factor (lb/item) = 3.69E-06
Cl_2 Corrected Emission Factor (lb/lb NEW) = 4.79E-04

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CALCULATION SHEET

Calc. No. 1

Signature William L. McCarter Date 02/01/99 Checked John Carson Date 02/02/99
Project AEC Phase I Emissions Characterization Job No. 655257.05
Subject AEC Munition Item Dioxin/Furan Data Sheet for Sample Calculations

EMISSION FACTOR CALCULATION OF DIOXIN/FURAN DATA

Input Data Given (Appendix II-A, Tables A-1 and A-2 and Appendix II-H, Tables H-1 and H-2):

Dioxin/Furan data is reported by individual isomer and as the toxic equivalent (TEQ) to 2,3,7,8-TCDD using toxicity equivalency factors.

Units are in picograms (pg). 1 pg = 1 x 10^{-12}g

Not included in the TEQ calculation.

Concentration and Volume		Train A	Train B	Train A	Train B	Avg.	Bkgd.
Dioxin/Furan (ft^3)		100.47	81.98	-	-	91.23	150.2
Compound	**TEF**	**Mass (pg)**		**TEQ (pg)**			
1,2,3,4,6,7,8-HpCDD	0.01		7.9		0.079	0.08	
1,2,3,4,6,7,8,9-OCDD	0.001	70.4	36	0.070	0.036	0.05	
Total PeCDD			5.5				
Total HpCDD			15.7				
2,3,7,8-TCDF	0.1		5.4		0.540	0.54	
1,2,3,4,7,8-HxCDF	0.1	4.8	4.4	0.480	0.440	0.46	0.53
1,2,3,6,7,8-HxCDF	0.1	2.5		0.250		0.25	
2,3,4,6,7,8-HxCDF	0.1	3.4	2.8	0.340	0.280	0.31	
1,2,3,4,6,7,8,9-OCDF	0.001		8.2		0.008	0.01	
Total TCDF			5.4				
Total PeCDF			7.1				
Total HxCDF		16.3	12.5				
Dioxin TEQ				**1.1404**	**1.3832**		**0.53**

Average and Background Concentrations (Appendix II-A, Tables A-3 and A-4, Appendix II-H, Tables H-1 and H-2):

$$\text{Dioxin/Furan Train A Concentration (mg/m}^3\text{)} = \frac{[\text{Sample Concentration (pg)} \times (10^{-12}\text{ g / 1 pg}) \times (1\text{ mg / }10^{-3}\text{ g})]}{[\text{Train A Sample Volume (ft}^3\text{)} \times 1\text{ m}^3\text{ / 35.3145 ft}^3]}$$

$$\text{Dioxin/Furan Train A Concentration (mg/m}^3\text{)} = \frac{1.14\text{E-09 mg}}{2.8\text{ m}^3} = 4.01\text{E-10 mg/m}^3$$

$$\text{Dioxin/Furan Train B Concentration (mg/m}^3\text{)} = \frac{1.38\text{E-09 mg}}{2.3\text{ m}^3} = 5.96\text{E-10 mg/m}^3$$

Average Concentration (mg/m^3) = $\boxed{4.98\text{E-10 mg/m}^3}$

Background Concentration (mg/m^3) = $\boxed{1.25\text{E-10 mg/m}^3}$

These are the calculated sample concentrations for the dioxin/furan data. The other dioxin/furan data is calculated similarly.

Corrected Concentrations (Appendix II-A, Table A-4):

Average Concentration (mg/m^3) = 4.98E-10 -
Background Concentration (mg/m^3) = 1.25E-10
Background Corrected Concentration [BCC] (mg/m^3) = $\boxed{3.74\text{E-10}}$

Subtraction of background concentration from the average concentration

Dilution Correction Factor [DCF] = 0.8281
Corrected Concentration [CC] (mg/m^3) = $\boxed{4.51\text{E-10}}$ = BCC / DCF
Initial Plume Volume (ft^3) = 36248

Sample Total Material (lb) in BangBox = $\boxed{1.02\text{E-12}}$ = [CC x (10^{-3} g / mg) x (2.20462 lb / 1000 g)] x [Initial Plume Volume (ft^3) x (1 m^3 / 35.3145 ft^3)]

Number of Items = 29
Net Explosive Weight (lb) = 0.22

Dioxin/Furan Corrected Emission Factor (lb/item) = 3.52E-14
Dioxin/Furan Corrected Emission Factor (lb/lb NEW) = 4.57E-12

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CALCULATION SHEET

Calc. No. 1

Signature William L. McCarter Date 02/01/99 Checked John Carson Date 02/02/99
Project AEC Phase I Emissions Characterization Job No. 655257.05
Subject AEC Munition Item CEM Data Sheet for Sample Calculations

EMISSION FACTOR CALCULATION OF CEM DATA

Input Data Given (Appendix II-A, Table A-1 and Appendix II-I, Table I-1):

Analytical data for the CO, CO_2, NO_x, HCl, and SO_2 continuous analyzers are recorded electronically by the Dugway Proving Ground Data Acquisition System (DAS).

Concentration Data (CEM)	Sample 1	Avg.		
NO_x Background Run No. 1 (ppmv)	0.00972	0.01	9.720	ppbv
NO_x Run No. 1 (ppmv)	0.258861	0.26	258.861	ppbv

Average and Background Concentrations (Appendix II-A, Tables A-3 and A-4, Appendix II-I, Table I-1):

To express at standard conditions:

p =	1.0133E+05 Pa	pV = n R T ; n = m / MW
R =	8.314 m^3 Pa/gmol K	m = mass (grams)
T =	293.15 K	V = volume (m^3)
Molecular Weight (MW) =	46 g/gmol (NO_x)	pV = m R T / MW
m / V (g/m^3) =	4.16E-05 x MW x ppmv	**m / V = p MW / R T**
m / V (mg/m^3) =	0.0416 x MW x ppmv	ppm = ppb / 1000
ppbv =	(mg/m^3 / 0.0416 / MW) x 1000	mg/m^3 = ug/m^3 / 1000

Average Concentration (mg/m^3) = $\boxed{4.95E-01 \text{ mg/m}^3}$ These are the calculated sample concentrations corrected for standard conditions

Background Concentration (mg/m^3) = $\boxed{1.86E-02 \text{ mg/m}^3}$ These are the calculated sample concentrations for the NO_x data. The other CEM data is calculated similarly.

Corrected Concentrations (Appendix II-A, Table A-4):

Average Concentration (mg/m^3) = 4.95E-01 -
Background Concentration (mg/m^3) = 1.86E-02
Background Corrected Concentration [BCC] (mg/m^3) = $\boxed{4.77E-01}$ Subtraction of background concentration from the average concentration

Dilution Correction Factor [DCF] = 0.8281
Corrected Concentration [CC] (mg/m^3) = $\boxed{5.76E-01}$ = BCC / DCF
Initial Plume Volume (ft^3) = 36248

Sample Total Material (lb) in BangBox = $\boxed{1.30E-03}$ = [CC x (10^{-3} g / mg) x (2.20462 lb / 1000 g)] x [Initial Plume Volume (ft^3) x (1 m^3 / 35.3145 ft^3)]

Number of Items = 29
Net Explosive Weight (lb) = 0.22

NO_x Corrected Emission Factor (lb/item) = 4.49E-05
NO_x Corrected Emission Factor (lb/lb NEW) = 5.83E-03

RADIAN INTERNATIONAL
A DAMES & MOORE GROUP COMPANY

CALCULATION SHEET

Calc. No. 1

Signature William L. McCarter Date 02/01/99 Checked John Carson Date 02/02/99
Project AEC Phase I Emissions Characterization Job No. 655257.05
Subject AEC Munition Item Data Evaluation Sheet for Sample Calculations

DATA EVALUATION CALCULATION OF DATA "QUALIFIERS"

Input Data Given (Data Evaluation pages in Appendix II-A): this example is for SVOC data only, all other data qualifiers are calculated similarly.

Average Concentration (mg/m^3) = 3.62E-04 mg/m^3 ACETOPHENONE

Background Concentration (mg/m^3) = 2.81E-04 mg/m^3 These are the calculated sample concentrations for the acetophenone data. The other SVOC data is calculated similarly.

Minimum Detection Limit Concentration (mg/m^3) = 1.33E-04 mg/m^3 The minimum detection limit is based upon the minimum analytical detection limit and the average sample volume. For the metals, the average TSP mass is used.

For the example using SVOC data, see Appendix II-F, Table F-3.

Background Evaluation Criteria = 1.29 $= \frac{\text{Average Concentration}}{\text{Background Concentration}}$

Background Evaluation Note = D

Minimum DL Evaluation Criteria = 2.73 $= \frac{\text{Average Concentration}}{\text{Minimum DL Concentration}}$

Minimum DL Evaluation Note = C

A = Identified as a contaminant (greater than or equal to 10 times background or minimum MQL)
B = Likely contaminant (less than 10 and greater than or equal to 5 times background or minimum MQL)
C = Probable contaminant (less than 5 and greater than or equal to 2 times background or minimum MQL)
D = Measured, but accuracy or presence questionable (less than 2 and greater than or equal to 1 times background or minimum MQL)
F = Not considered a contaminant (less than 1 times background or minimum MQL)

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APPENDIX I-D. MIDAS DATA

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Table D-1. Simulator Booby Trap Flash M117 MIDAS Data

DODIC	Nomenclature	Description	Weight grains	Weight grams	Weight oz	Weight lb	Compound	Percent	Compound lb
L598	Simulator Booby Trap Flash M117	PEP (Flash Comp)		2.5	0.08818	5.511E-03	MG Powder	17.00%	9.369E-04
				2.5	0.08818	5.511E-03	K Perchlorate	50.00%	2.755E-03
				2.5	0.08818	5.511E-03	SB Sulfide	33.00%	1.819E-03
		Matchhead Comp	9.5		0.01979	1.237E-03	Red Phosphorus	53.00%	6.556E-04
			9.5		0.01979	1.237E-03	Charcoal	5.00%	6.185E-05
			9.5		0.01979	1.237E-03	SB Sulfide	42.00%	5.195E-04
		PEP (Starter Paste)	19.4		0.04042	2.526E-03	Binder Cell Nitrate	15.00%	3.789E-04
			19.4		0.04042	2.526E-03	K nitrate	62.90%	1.589E-03
			19.4		0.04042	2.526E-03	S	8.84%	2.233E-04
			19.4		0.04042	2.526E-03	Charcoal	13.26%	3.349E-04
		PEP (Scratch Comp)	19.17		0.03994	2.496E-03	K Chlorate	52.00%	1.298E-03
			19.17		0.03994	2.496E-03	SB Sulfide	31.00%	7.738E-04
			19.17		0.03994	2.496E-03	Dextrin	17.00%	4.243E-04

Table D-2. Simulator Flash Artillery MIDAS Data

DODIC	Nomenclature	Description	Weight	Weight	Weight	Weight	Compound	Percent	Compound
			grains	grams	oz	lb			lb
L596	Simulator Flash Artillery M110	PEP (Flash Comp)		85	2.99795	1.874E-01	MG Powder	45.00%	8.432E-02
				85	2.99795	1.874E-01	K Perchlorate	35.00%	6.558E-02
				85	2.99795	1.874E-01	BA Nitrate	15.00%	2.811E-02
				85	2.99795	1.874E-01	BA Oxalate	3.00%	5.621E-03
				85	2.99795	1.874E-01	CA Oxalate	1.00%	1.874E-03
				85	2.99795	1.874E-01	Graphite	1.00%	1.874E-03
		Smokeless Powder	2		0.00417	2.604E-04	Smokeless Powder	100.00%	2.604E-04
		PEP (Black Powder CL7) ALT		0.115	0.00406	2.535E-04	K nitrate	74.00%	1.876E-04
				0.115	0.00406	2.535E-04	S	10.40%	2.636E-05
				0.115	0.00406	2.535E-04	Charcoal	15.60%	3.955E-05

Table D-3. Simulator Hand Grenade MIDAS Data

DODIC	Nomenclature	Description	Weight	Weight	Weight	Weight	Compound	Percent	Compound
			grains	grams	oz	lb			lb
L601	Simulator Hand Grenade M116A1	PEP (Priming Paste)	0.2		0.00042	2.604E-05	K nitrate	66.60%	1.734E-05
			0.2		0.00042	2.604E-05	S	9.36%	2.437E-06
			0.2		0.00042	2.604E-05	Charcoal	14.04%	3.656E-06
			0.2		0.00042	2.604E-05	Binder cell Nitrate	10.00%	2.604E-06
		PEP (Ign Charge)		0.041	0.00145	9.038E-05	K Perchlorate	88.00%	7.953E-05
				0.041	0.00145	9.038E-05	Charcoal	10.00%	9.038E-06
				0.041	0.00145	9.038E-05	Dextrin	2.00%	1.808E-06
		Friction Comp	1.4		0.00292	1.823E-04	Red Phosphorus	21.40%	3.901E-05
			1.4		0.00292	1.823E-04	Shellac	78.60%	1.433E-04
		PEP (Black Powder)	0.5		0.00104	6.510E-05	K nitrate	74.00%	4.818E-05
			0.5		0.00104	6.510E-05	S	10.40%	6.771E-06
			0.5		0.00104	6.510E-05	Charcoal	15.60%	1.016E-05
		Chg Photoflash			1.3	8.125E-02	MG Powder	34.00%	2.763E-02
					1.3	8.125E-02	K Perchlorate	40.00%	3.250E-02
					1.3	8.125E-02	AL Powder	26.00%	2.113E-02

Table D-4. Simulator Ground Burst MIDAS Data

DODIC	Nomenclature	Description	Weight grains	Weight grams	Weight oz	Weight lb	Compound	Percent	Compound lb
L594	Simulator Proj Grnd Burst M115A2	PEP (Priming Paste)	0.2		0.00042	2.604E-05	K nitrate	66.60%	1.734E-05
			0.2		0.00042	2.604E-05	S	9.36%	2.437E-06
			0.2		0.00042	2.604E-05	Charcoal	14.04%	3.656E-06
			0.2		0.00042	2.604E-05	Binder cell Nitrate	10.00%	2.604E-06
	Chg loading assy	PEP (Flash Comp)			2.3	1.438E-01	AL powder	42.50%	6.109E-02
					2.3	1.438E-01	K Perchlorate	57.50%	8.266E-02
	Whistle loading assy	PEP (Whistle Comp)		2	0.07054	4.409E-03	K Perchlorate	69.00%	3.042E-03
				2	0.07054	4.409E-03	NA Salcylate	28.00%	1.234E-03
				2	0.07054	4.409E-03	Gum Red	3.00%	1.323E-04
		PEP (Black Powder)	4.57		0.00952	5.950E-04	K nitrate	74.00%	4.403E-04
			4.57		0.00952	5.950E-04	S	10.40%	6.188E-05
			4.57		0.00952	5.950E-04	Charcoal	15.60%	9.283E-05
		PEP (Ign Charge)		0.041	0.00145	9.038E-05	K Perchlorate	88.00%	7.953E-05
				0.041	0.00145	9.038E-05	Charcoal	10.00%	9.038E-06
				0.041	0.00145	9.038E-05	Dextrin	2.00%	1.808E-06
		Friction Comp	1.4		0.00292	1.823E-04	Red Phosphorus	21.40%	3.901E-05
			1.4		0.00292	1.823E-04	Shellac	78.60%	1.433E-04

Table D-5. Green Star Cluster Signal Flare MIDAS Data

DODIC	Nomenclature	Description	Weight grains	Weight grams	Weight oz	Weight lb	Compound	Percent	Compound lb
L314	Signal Illum Grnd M125A1	PEP (Black Powder CL5)		0.0759	0.00268	1.673E-04	K nitrate	74.00%	1.238E-04
				0.0759	0.00268	1.673E-04	S	10.40%	1.740E-05
				0.0759	0.00268	1.673E-04	Charcoal	15.60%	2.610E-05
		PEP (Flash Comp)		0.09	0.00317	1.984E-04	ZR	58.00%	1.151E-04
				0.09	0.00317	1.984E-04	CR oxide	16.00%	3.174E-05
				0.09	0.00317	1.984E-04	MO trioxide	25.00%	4.960E-05
				0.09	0.00317	1.984E-04	Vinal Alchol	1.00%	1.984E-06
		PEP (ign comp mix) (alt)		0.08	0.00282	1.764E-04	B Amorphous Pwdr	25.00%	4.409E-05
				0.08	0.00282	1.764E-04	K Perchlorate	75.00%	1.323E-04
		PEP (Black Powder CL7)ALT		0.14	0.00494	3.086E-04	K nitrate	74.00%	2.284E-04
				0.14	0.00494	3.086E-04	S	10.40%	3.210E-05
				0.14	0.00494	3.086E-04	Charcoal	15.60%	4.814E-05
		PEP (Delay Comp Mix)		0.57	0.0201	1.256E-03	Vinyl Alchool	0.30%	3.769E-06
				0.57	0.0201	1.256E-03	K Perchlorate	11.40%	1.432E-04
				0.57	0.0201	1.256E-03	Ba Chromate	56.30%	7.074E-04
				0.57	0.0201	1.256E-03	W	32.00%	4.021E-04
		PEP Illum Comp MG 30/50 TP1			0.5	3.125E-02	MG Powder 30/50	33.00%	1.031E-02
					0.5	3.125E-02	BA nitrate	46.00%	1.438E-02
					0.5	3.125E-02	Polyvinyl Chloride	16.00%	5.000E-03
					0.5	3.125E-02	Laminac	4.90%	1.531E-03
					0.5	3.125E-02	Lupersol DDM	0.08%	2.500E-05
					0.5	3.125E-02	CO Naphthenate	0.03%	9.375E-06
		PEP Illum Comp MG 30/50 TP3 ALT			0.5	3.125E-02	MG Powder 30/50	33.00%	1.031E-02
					0.5	3.125E-02	BA nitrate	46.00%	1.438E-02
					0.5	3.125E-02	Polyvinyl Chloride	16.00%	5.000E-03
					0.5	3.125E-02	Laminac	4.89%	1.528E-03
					0.5	3.125E-02	Lupersol DDM	0.08%	2.500E-05
					0.5	3.125E-02	CO Naphthenate	0.03%	9.375E-06
		PEP Illum Comp MG 30/50 TP4 ALT			0.5	3.125E-02	MG Powder 30/50	33.00%	1.031E-02
					0.5	3.125E-02	BA nitrate	46.00%	1.438E-02
					0.5	3.125E-02	Polyvinyl Chloride	16.00%	5.000E-03
					0.5	3.125E-02	Laminac	4.89%	1.528E-03
					0.5	3.125E-02	Lupersol DDM	0.08%	2.500E-05
					0.5	3.125E-02	CO Naphthenate	0.03%	9.375E-06
		PEP (PYRO 1st fire comp grn)	2		0.5	3.125E-02	BA nitrate	50.00%	1.563E-02
			2		0.5	3.125E-02	Tetranitrocarbazole	10.00%	3.125E-03
			2		0.5	3.125E-02	SI	13.00%	4.063E-03
			2		0.5	3.125E-02	ZR Hydride	20.00%	6.250E-03
			2		0.5	3.125E-02	Laminac/Lupersol	4.00%	1.250E-03
			2		0.5	3.125E-02	Polyvinyl Chloride	3.00%	9.375E-04

Table D-5. (Continued)

DODIC	Nomenclature	Description	Weight	Weight	Weight	Weight	Compound	Percent	Compound
			grains	grams	oz	lb			lb
		PEP (quickmatch mix)	2		0.00417	2.604E-04	Cotton wick	0.00%	0.000E+00
			2		0.00417	2.604E-04	K nitrate	74.00%	1.927E-04
			2		0.00417	2.604E-04	Charcoal	15.60%	4.062E-05
			2		0.00417	2.604E-04	S	10.40%	2.708E-05
		Grain Prop (black pwdr mix)		13	0.45851	2.866E-02	K nitrate	67.40%	1.931E-02
				13	0.45851	2.866E-02	Charcoal	14.20%	4.069E-03
				13	0.45851	2.866E-02	S	9.50%	2.722E-03
				13	0.45851	2.866E-02	CA Carbonate	8.90%	2.550E-03
		PEP (primer mix #955)	0.9		0.00187	1.172E-04	PB Styphnate	40.00%	4.687E-05
			0.9		0.00187	1.172E-04	PETN	5.00%	5.859E-06
			0.9		0.00187	1.172E-04	BA nitrate	30.00%	3.516E-05
			0.9		0.00187	1.172E-04	SB Sulfide	15.00%	1.758E-05
			0.9		0.00187	1.172E-04	AL powder	6.00%	7.031E-06
			0.9		0.00187	1.172E-04	Tetracene	4.00%	4.687E-06

Table D-6. Green Parachute Signal Flare MIDAS Data

DODIC	Nomenclature	Description	Weight	Weight	Weight	Weight	Compound	Percent	Compound
			grains	grams	oz	lb			lb
L305	Signal Illum Grnd Para Grn Star M195	PEP (Black Powder CL5)		1.46	0.05149	3.218E-03	K nitrate	74.00%	2.382E-03
				1.46	0.05149	3.218E-03	S	10.40%	3.347E-04
				1.46	0.05149	3.218E-03	Charcoal	15.60%	5.021E-04
		PEP (Flash Comp)		0.09	0.00317	1.984E-04	ZR	58.00%	1.151E-04
				0.09	0.00317	1.984E-04	CR oxide	16.00%	3.174E-05
				0.09	0.00317	1.984E-04	MO trioxide	25.00%	4.960E-05
				0.09	0.00317	1.984E-04	Vinyl Alcohol	1.00%	1.984E-06
		PEP (ign comp mix) (alt)		0.08	0.00282	1.764E-04	B Amorphous Pwdr	25.00%	4.409E-05
				0.08	0.00282	1.764E-04	K Perchlorate	75.00%	1.323E-04
		PEP (Black Powder CL7)ALT		0.14	0.00494	3.086E-04	K nitrate	74.00%	2.284E-04
				0.14	0.00494	3.086E-04	S	10.40%	3.210E-05
				0.14	0.00494	3.086E-04	Charcoal	15.60%	4.814E-05
		PEP (Delay Comp Mix)		0.57	0.0201	1.256E-03	Vinyl Alcohol	0.30%	3.769E-06
				0.57	0.0201	1.256E-03	K Perchlorate	11.40%	1.432E-04
				0.57	0.0201	1.256E-03	Ba Chromate	56.30%	7.074E-04
				0.57	0.0201	1.256E-03	W	32.00%	4.021E-04
		PEP (Illum Comp)			99	6.188E+00	MG Powder	22.00%	1.361E+00
					99	6.188E+00	BA nitrate	48.00%	2.970E+00
					99	6.188E+00	K Perchlorate	10.00%	6.188E-01
					99	6.188E+00	Dechlorane	15.00%	9.281E-01
					99	6.188E+00	Binder Comp	5.00%	3.094E-01
		Starter Mix 25			0.001	6.250E-05	SI	24.50%	1.531E-05
					0.001	6.250E-05	K nitrate	33.00%	2.063E-05
					0.001	6.250E-05	Charcoal	3.80%	2.375E-06
					0.001	6.250E-05	FE Oxide	20.70%	1.294E-05
					0.001	6.250E-05	AL powder	12.00%	7.500E-06
					0.001	6.250E-05	NC	6.00%	3.750E-06
		PEP (Black Powder)		16.28	0.5742	3.589E-02	K nitrate	74.00%	2.656E-02
				16.28	0.5742	3.589E-02	S	10.40%	3.732E-03
				16.28	0.5742	3.589E-02	Charcoal	15.60%	5.598E-03
		Grain Prop (black pwdr mix)		13	0.45851	2.866E-02	K nitrate	67.40%	1.931E-02
				13	0.45851	2.866E-02	Charcoal	14.20%	4.069E-03
				13	0.45851	2.866E-02	S	9.50%	2.722E-03
				13	0.45851	2.866E-02	CA Carbonate	8.90%	2.550E-03
		PEP (primer mix #955)	0.9		0.00187	1.172E-04	PB Styphnate	40.00%	4.687E-05
			0.9		0.00187	1.172E-04	PETN	5.00%	5.859E-06
			0.9		0.00187	1.172E-04	BA nitrate	30.00%	3.516E-05
			0.9		0.00187	1.172E-04	SB Sulfide	15.00%	1.758E-05
			0.9		0.00187	1.172E-04	AL powder	6.00%	7.031E-06
			0.9		0.00187	1.172E-04	Tetracene	4.00%	4.687E-06

Table D-7. White Parachute Signal Flare MIDAS Data

DODIC	Nomenclature	Description	Weight grains	Weight grams	Weight oz	Weight lb	Compound	Percent	Compound lb
L312	Signal Illum Grnd M127	PEP (Black Powder CL5)		1.46	0.05149	3.218E-03	K nitrate	74.00%	2.382E-03
				1.46	0.05149	3.218E-03	S	10.40%	3.347E-04
				1.46	0.05149	3.218E-03	Charcoal	15.60%	5.021E-04
		Grain Prop (black pwdr mix)		13	0.45851	2.866E-02	K nitrate	67.40%	1.931E-02
				13	0.45851	2.866E-02	Charcoal	14.20%	4.069E-03
				13	0.45851	2.866E-02	S	9.50%	2.722E-03
				13	0.45851	2.866E-02	CA Carbonate	8.90%	2.550E-03
		PEP (Flash Comp)		0.09	0.00317	1.984E-04	ZR	58.00%	1.151E-04
				0.09	0.00317	1.984E-04	CR oxide	16.00%	3.174E-05
				0.09	0.00317	1.984E-04	MO trioxide	25.00%	4.960E-05
				0.09	0.00317	1.984E-04	Vinal Alchol	1.00%	1.984E-06
		PEP (Black Powder CL7)ALT		0.14	0.00494	3.086E-04	K nitrate	74.00%	2.284E-04
				0.14	0.00494	3.086E-04	S	10.40%	3.210E-05
				0.14	0.00494	3.086E-04	Charcoal	15.60%	4.814E-05
		PEP (ign comp mix) (alt)		0.08	0.00282	1.764E-04	B Amorphous Pwdr	25.00%	4.409E-05
				0.08	0.00282	1.764E-04	K Perchlorate	75.00%	1.323E-04
		PEP (Delay Comp Mix)		0.57	0.0201	1.256E-03	Vinyl Alchool	0.30%	3.769E-06
				0.57	0.0201	1.256E-03	K Perchlorate	11.40%	1.432E-04
				0.57	0.0201	1.256E-03	Ba Chromate	56.30%	7.074E-04
				0.57	0.0201	1.256E-03	W	32.00%	4.021E-04
		PEP (PYRO 1st fire comp ylw)	2		0.00417	2.604E-04	BA nitrate	50.00%	1.302E-04
			2		0.00417	2.604E-04	Tetranitrocarbazole	10.00%	2.604E-05
			2		0.00417	2.604E-04	SI	20.00%	5.208E-05
			2		0.00417	2.604E-04	ZR Hydride	15.00%	3.906E-05
			2		0.00417	2.604E-04	Laminac/Lupersol	5.00%	1.302E-05
		PEP Illum Comp 1*1		85	2.99795	1.874E-01	MG Powder 30/50	66.00%	1.237E-01
				85	2.99795	1.874E-01	NA nitrate	29.00%	5.434E-02
				85	2.99795	1.874E-01	Laminac	4.89%	9.162E-03
				85	2.99795	1.874E-01	CO Naphthenate	0.02%	3.747E-05
		PEP Illum Comp 1*2 ALT		85	2.99795	1.874E-01	MG Powder 30/50	66.00%	1.237E-01
				85	2.99795	1.874E-01	NA nitrate	29.00%	5.434E-02
				85	2.99795	1.874E-01	Laminac	4.89%	9.162E-03
				85	2.99795	1.874E-01	CO Naphthenate	0.02%	3.747E-05
		PEP Illum Comp 2*1 ALT		85	2.99795	1.874E-01	MG Powder 30/50	65.00%	1.218E-01
				85	2.99795	1.874E-01	NA nitrate	31.00%	5.809E-02
				85	2.99795	1.874E-01	Vinyl Alcohol	4.00%	7.495E-03
		PEP (Black Powder)	4.07		0.00848	5.299E-04	K nitrate	74.00%	3.922E-04
			4.07		0.00848	5.299E-04	S	10.40%	5.511E-05
			4.07		0.00848	5.299E-04	Charcoal	15.60%	8.267E-05
		PEP (primer mix #955)	0.9		0.00187	1.172E-04	PB Styphnate	40.00%	4.687E-05

Table D-7. (Continued)

DODIC	Nomenclature	Description	Weight	Weight	Weight	Weight	Compound	Percent	Compound
			grains	grams	oz	lb			lb
			0.9		0.00187	1.172E-04	PETN	5.00%	5.859E-06
			0.9		0.00187	1.172E-04	BA nitrate	30.00%	3.516E-05
			0.9		0.00187	1.172E-04	SB Sulfide	15.00%	1.758E-05
			0.9		0.00187	1.172E-04	AL powder	6.00%	7.031E-06
			0.9		0.00187	1.172E-04	Tetracene	4.00%	4.687E-06

Table D-8. 155mm Illumination Round MIDAS Data

DODIC	Nomenclature	Description	Weight	Weight	Weight	Weight	Compound	Percent	Compound
			grains	grams	oz	lb			lb
D505	Proj 155MM Illum M485E1								
	Expelling Chg primary load	PEP (black Powder CL3)		95	3.35065	2.094E-01	K nitrate	74.00%	1.550E-01
				95	3.35065	2.094E-01	S	10.40%	2.178E-02
				95	3.35065	2.094E-01	Charcoal	15.60%	3.267E-02
	Delay holder loading assy	PEP (Delay Comp Mix)		1.32	0.04656	2.910E-03	MN powder	42.00%	1.222E-03
				1.32	0.04656	2.910E-03	BA chromate	5.00%	1.455E-04
				1.32	0.04656	2.910E-03	PB chromate	53.00%	1.542E-03
		PEP (Black Powder CL7 (K NIT CL1))		0.15	0.00529	3.307E-04	K nitrate	74.00%	2.447E-04
				0.15	0.00529	3.307E-04	S	10.40%	3.439E-05
				0.15	0.00529	3.307E-04	Charcoal	15.60%	5.158E-05
		Ign Powder A1A		0.14	0.00494	3.086E-04	ZR	65.00%	2.006E-04
				0.14	0.00494	3.086E-04	Fe oxide red	25.00%	7.715E-05
				0.14	0.00494	3.086E-04	diatomaceous earth	10.00%	3.086E-05
	Expelling chg assy	PEP (Black Powder CL6)		10.6	0.37386	2.337E-02	K nitrate	74.00%	1.729E-02
				10.6	0.37386	2.337E-02	S	10.40%	2.430E-03
				10.6	0.37386	2.337E-02	Charcoal	15.60%	3.645E-03
		PEP (Black Powder CL6)		7	0.24689	1.543E-02	K nitrate	74.00%	1.142E-02
				7	0.24689	1.543E-02	S	10.40%	1.605E-03
				7	0.24689	1.543E-02	Charcoal	15.60%	2.407E-03
	Illumination	PEP (Illum Comp)			94	5.875E+00	MG powder	48.50%	2.849E+00
					94	5.875E+00	NA nitrate	43.70%	2.567E+00
					94	5.875E+00	epoxy resin	1.99%	1.169E-01
					94	5.875E+00	polysulfide	5.57%	3.272E-01
					94	5.875E+00	cure agent	0.24%	1.410E-02
		PEP (first fire comp)			2	1.250E-01	BA nitrate	50.00%	6.250E-02
					2	1.250E-01	SI	20.00%	2.500E-02
					2	1.250E-01	ZR hydride	15.00%	1.875E-02
					2	1.250E-01	Tetranitrocarbazole	10.00%	1.250E-02
					2	1.250E-01	Laminac	4.93%	6.163E-03
					2	1.250E-01	Catalyst lupersol	0.07%	8.750E-05